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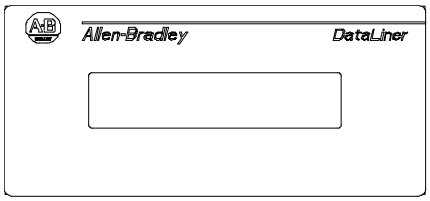
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Allen-Bradley

Bulletin 2706 Dataliner Message Display DL5 Series

User Manual



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Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

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Allen-Bradley T3 Terminal
Serial Communications Cable (Catalog No. 2706-NC15) B-1

Allen-Bradley 1745-T45 Terminal, VT100 or IBM XT & Compatibles
Serial Communications Cable (Cat. No. 2706-NC12) B-2

Allen-Bradley 6121 or T50 Terminal, IBM AT & Compatibles
Serial Communications Cable (Cat.No. 2706-NC13) B-2

Allen-Bradley 6120 or Industrial PC / XT
Serial Communications Cable (Cat. No. 2706-NC14) B-3

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Using this Manual

Chapter Objectives

Read this chapter to familiarize yourself with the rest of the manual. You will learn about:

- Contents of this manual
- Intended audience
- Conventions used

This manual will instruct you on how to install and use your Dataliner DL5. display. The manual is divided into the following chapters:

Chapter	Title	Purpose
Preface	Using this Manual	Provides an overview of the manual.
1	Introduction to the DL5	Describes the main features and operating capabilities of the DL5.
2	Getting Started	Provides instructions for the initial desktop setup along with a description of the menus and prompts.
3	Entering New Messages	Provides step-by-step instructions on how to enter a message along with message attributes.
4	Reviewing and Editing Messages	Provides instructions on reviewing and editing previously entered messages.
5	The Run Mode	Describes the operation of the DL5 while in the run mode.
6	Using the Serial Port	Describes the operation of the serial port.
7	Using the Parallel Port	Describes the connection and operation of the parallel port.
8	Special Functions	Describes the functions available under the Special Functions menu.
9	Using the Variable Data Feature	Provides instructions on how to embed variable data in a message.
10	Using the DL5 Parallel Port to Replace Pilot Lights	Provides instructions on how to use the DL5 Pilot Light replacement run modes.
11	Using the DL5 to Replace BCD Displays and Lookup Tables	Provides instructions on how to replace BCD displays with a DL5.
12	Installation Instructions	Describes the installation requirements for mounting the display.

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Chapter	Title	Purpose
13	Maintenance and Troubleshooting	Provides general maintenance instructions. Also provides instructions on solving some of the most common operating problems.
14	Specifications	Electrical, mechanical, environmental specifications
	Appendices, Glossary, Index	

Intended Audience

No special knowledge is needed to enter or edit messages. However, since the Dataliner message display must be connected to peripheral equipment, you should be familiar with computer communication terminology.

Conventions

The following conventions are used:

- Messages displayed on the DL5 are shown inside a rectangular box.

  EDIT?

- A symbol or word in brackets represent a single key that you should press. These include keys such as [A] or [Retrn].

- Since the DL5 can be programmed with a variety of terminals, the printing on your terminal keyboard may be different than the symbol or word indicated in brackets. In this manual, we use [Retrn] to specify the carriage return function of the keyboard. On your keyboard this may correspond to the [Enter] or [↵] keys.

- Angle brackets, < >, are used when you are to enter variable data. For example, <message number>, means you are to enter a message number at that point.

- In the following chapters, we refer to the Dataliner DL5 Series Message Display as the DL5.

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Introduction to the DL5

Chapter Objectives

This chapter briefly describes some of the key features and operating capabilities of the DL5. If you require more detailed information, refer to the section of the manual that describes the use of the feature or operating capability.

Overview

The DL5 stores messages of varying length within its own memory. The stored messages are displayed when the DL5 receives a command from your control system. The messages can be used to show a status condition, help diagnose a problem, or prompt an operator.

The Bulletin 2706 DL5 Series Dataliner Message Display (DL5) is available with two display options:

- One line display (16 characters)
- Two line display (16 characters per line)

Note: The operation of the one and two line displays is similar. The few exceptions are noted in this manual.

You can use a variety of devices to program the DL5

- The Allen-Bradley line of industrial terminals (T1 through T4).
- Most DTE type “dumb” terminals.
- DEC VT100, VT101 terminals.
- IBM compatible computers, including Allen-Bradley RAC6000 industrial computers, using the DL5 offline programming software (Catalog No. 2706-NP5).
- The 16 character display can show a wide variety of characters and symbols, including:
  - Uppercase letters
  - Punctuation

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Main Features

Serial or Parallel Triggering - Stored messages can be triggered by sending messages to the DL5 serial or parallel ports. Both the serial and parallel ports cannot be used at the same time. The Serial Trigger/ Configure DIP switch (SW1-1) on the back of the DL5 determines which port is used for triggering.

DC Input - The parallel port of the DL5 accepts 5-24 volts DC. DL5s are powered by 12-24 volts DC.

Round Robin Mode - The round robin mode allows you to replace up to sixteen pilot lights, that are being used as status indicators, with a single DL5 display. Instead of your control system turning on a pilot light, it will trigger a message for display.

Priority Mode - The priority mode is similar to the round robin mode. However, the priority mode has an additional feature that allows you to designate certain messages as more important than other messages. If two or more messages are triggered at the same time, only the priority message will be displayed.

Numeric Mode - The numeric mode allows you to use the DL5 as a numeric only 3 or 4 digit (BCD) display. Your control system can transmit real time binary coded decimal (BCD) data to the DL5 for immediate display. Use the DL5 to display numbers as large as 999, 999, 999, 999, 999.

Binary or BCD Input Mode - Your control system can transmit data and message triggers in either binary or Binary Coded Decimal (BCD) formats. This allows the recall of up to:

- 94 messages with a one or two line 2K byte DL5
- 387 messages with a two line 8K byte DL5

Debug Mode - You can verify the operation of the program in a host programmable controller (PLC) using the debug function of the DL5. The debug mode will display the condition (ON or OFF) of the sixteen parallel port data lines.

Note: Special application considerations may be necessary for some types of controlling devices. Refer to Chapter 8 for more details.

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Memory Storage Capacity

The DL5 stores messages in blocks of 16 characters. Message blocks can be strung together to form messages longer than 16 characters. The one and two line 2Kbyte displays can store 94 message blocks (16 characters). The two line 8Kbyte displays can accommodate up to 387 message blocks. Both the one line and two line displays store messages in an EEPROM. No batteries for memory backup are required.

Programming Software

Allen-Bradley offers DL5 offline programming software (Catalog No. 2706-NP5) for IBM PC or compatible computers with a 3 $^{1}/_{2}$ inch disk drives. This includes Allen-Bradley RAC 6000 industrial computers.

Programming Cables

The following offline programming cables are available.

Serial Cable	Use with:
2706-NC12	Personal computers with 25-pin female communication port connector. DEC VT52, VT100, or VT101 terminals. Allen-Bradley RAC 6000 industrial computers.
2706-NC13	Personal computers with 9-pin female communication port connector (IBM AT and compatible). Allen-Bradley RAC 6000 industrial computers.
2706-NC14	Allen-Bradley RAC 6000 industrial computers (PC/XT).
2706-NC15	Allen-Bradley Industrial Terminals T1 through T4 (25-pin male connector).

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Getting Started

Chapter Objectives

In this chapter, you will learn how to set up the DL5 for desktop use. You will also become familiar with the opening menus and prompts.

Initial Desktop Hookup

To begin desktop programming of the DL5, you must have the following items:

- 12-24 VDC power supply.
- An Allen-Bradley Industrial Terminal (Catalog No. 1770-T1 through 1770-T4), a Data Terminal Equipment (DTE) type RS-232 “dumb” terminal, a DEC VT52, VT100, or VT101 terminal
- Personal computer with DL5 offline programming software.
- Programming cable

Note: The terminal or host computer must initially operate with the following protocol:

- 9600 baud rate
- 8 data bits
- no parity
- 1 stop bit

This is required for initial communications with the DL5. After initial hook up, change the baud rate using the DL5 menu.

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Initial Desktop Setup

To setup the DL5, perform the following steps:

Step 1

Connect DC power to the DC line terminals (TB2) on the back of the DL5.

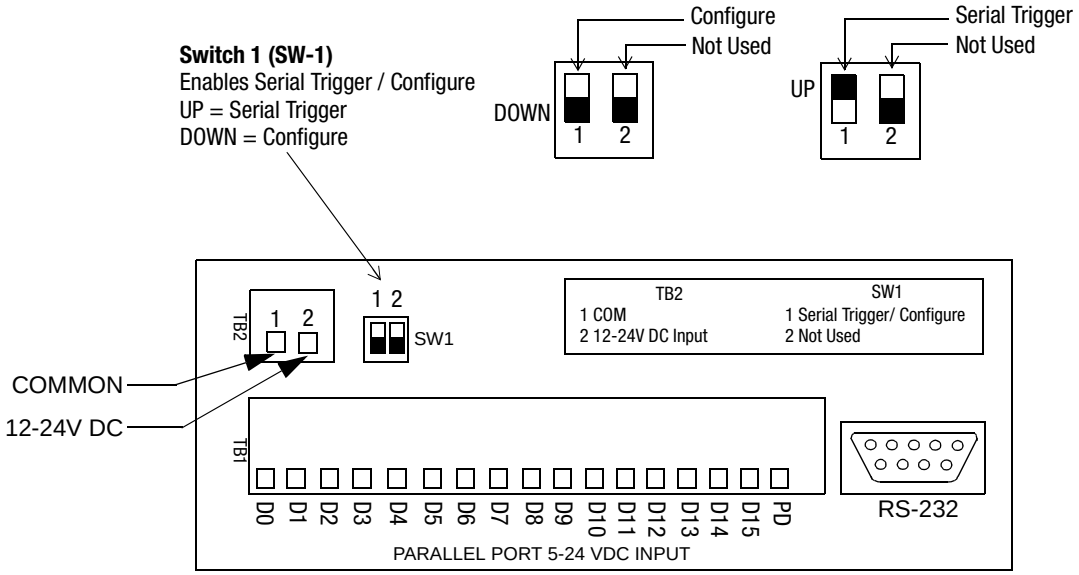
Note: The input voltage must be between 12 and 24 volts DC.

ATTENTION:
To avoid system ground loops, the same power supply must be used for the parallel port and the power input for the DL5.

The terminals are labeled as shown below.

For additional power supply requirements refer to the specifications listed in Chapter 14.

DC Line Terminals , Configure/Serial Trigger Switch



Step 2

Make sure the Serial Trigger / Configure switch is set to Configure (down).

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Step 3

Connect the programming device communications cable. Attach one end of the communications cable to an Allen-Bradley Industrial Terminal, a DTE Terminal, or computer. Since there are variations between the connections required, refer to the following guidelines:

- If you are using an Allen-Bradley Industrial Terminal, connect the "D" type connector on the communications cable (Catalog No. 2706-NC15) to port B on the terminal.
- If you are using a DTE type CRT terminal, connect the 2706-NC15 communications cable to the computer communications port on the terminal. The computer communications port is usually labeled "Main", "EIA", or "RS-232". Do not use the terminals labeled "Remote", "Printer", or "Auxiliary".
- If you are using a DEC VT52, VT100, or VT101, connect a Catalog Number 2706-NC12 cable to the "Main" or "RS-232" port.
- If you are using a computer and DL5 offline software, connect the appropriate programming cable to the COM1 serial communication port of the computer.

Note: For cable requirements, see Chapter 6. Cable diagrams can be found in Appendix B.

Step 4

Plug the other end of the communications cable into the connector labeled *RS-232* on the back of the DL5.

Step 5

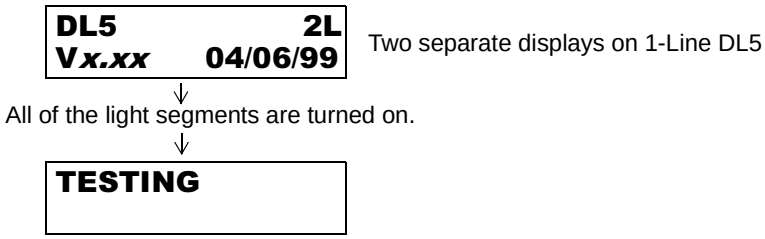
- Set your terminal or computer COM1 port to operate at:
- 9600 baud rate (default of the DL5)
- 8 data bits
- no parity
- 1 stop bit

Important: Some terminals require that power be cycled off and then on before changes to communications protocol take effect. If the DL5 had been previously programmed, the baud rate may have been changed to something other than 9600 baud (e.g., 300 or 1200). The DL5 will display its baud rate on power up.

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Initial Power Up of the DL5

When DC power is applied to the DL5, it will display:



Wait several seconds for the next display:



The memory display indicates the device memory capacity:

- 2Kbyte for Catalog No. 2706-D11J2 and -D21J2
- 8Kbyte for Catalog No. 2706-D21J8.

The SELF TEST OK display indicates that all of the diagnostic tests have been completed.

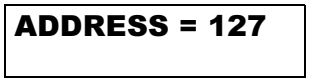


After the diagnostic tests are completed the DL5 will display:



Indicating the current baud rate of the RS-232 port. (Default is 9600 baud).

Then it will display the serial port address:.



And then depending on the DIP switch setting:





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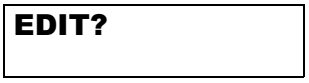
Then the DL5 displays the current run mode: (Numeric, Priority, Round Robin, Binary or BCD) Finally, it will indicate it is entering the run mode and display the AUTORUN message.

Note: The DL5 will always come up (after power down) in a *run* mode. This will be the last *run* mode that the unit was in before power down. The initial (out-of-the-box) default mode is numeric.

Press the [ESC] (Escape) key three times to exit the *run* mode. You will then be shown the RUN? prompt.



Press [N] and [Retrn] and you will be shown the EDIT? prompt.



You are now ready to enter messages as described in the next chapter. But first you should become familiar with the DL5's prompts and main menu.

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Responding to a Yes or No Prompt

There are three types of prompts that require a response:

- Yes or No prompts
- Numeric prompts
- Mnemonic prompts

The yes or no prompts appear as a word or words followed by a question mark (?). You must respond to a yes or no prompt with either the letter "Y" (Yes) or the letter "N" (No). For example, the following prompt appears:

```
EDIT?
```

If you press the [N] key (upper or lowercase), the display will show:

```
EDIT?N
```

You can change your mind by pressing the [Y] key (upper or lowercase). The display now shows:

```
EDIT?Y
```

Note: Only the letters "Y" or "N" are accepted as responses. You may change your response as many times as you would like prior to pressing the [Retrn] (carriage return) key.

If you press the [Retrn] key the selection is entered into the DL5's memory and the next prompt will be displayed.

A variation of the yes or no prompt is the default prompt. The default prompt provides an initial response or "default" for you. For example, assume the following prompt is displayed:

```
FLASH MESG?N
```

If you press the [Retrn] key, the response "No" would be entered into the DL5's memory. If you press the [Y] key, the prompt response will change as in the previous example:

```
FLASH MESG?Y
```


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Responding to a Numeric Prompt

The other type of prompt you will encounter is the numeric prompt. You must respond to a numeric prompt with a number. A numeric prompt will appear as a word or words followed by a colon (:). For example, assume the following prompt is displayed:

```
NUMBER:          0
```

If you were to press the key [2] the display would appear like this:

```
NUMBER:          2
```

Pressing the key [7] will cause the display to change as follows:

```
NUMBER:         27
```

Notice that the numbers that are entered scroll in from the right side. If you really wanted to enter the number “5”, you could type the new number in over the previous response by first typing in four zeroes (0000) followed by the desired number “5”.

Pressing the [Retrn] key will now enter your response into the memory of the DL5 and the next prompt will be displayed.

Numeric prompts may also have default values. For example, when the following is displayed:

```
WAIT TIME:       5
```

To record the number “5” as your response, press the [Retrn] key. If you want to enter another value, type over the default.

Press the [2] key, the display will show:

```
WAIT TIME:       2
```

If you press the [Retrn] key, the number “2” would be entered as your response for the wait time.

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Responding to a Mnemonic Prompt

The last type of prompt you must respond to is a Mnemonic Prompt. These only occur when selecting a run mode within the Special Functions menu of the display. These are entered just like numerics. Only alpha characters are accepted. If an invalid mnemonic is entered, the original prompt with the current run mode mnemonic will be displayed. Valid run mode Mnemonics are:

NM= NUMERIC

PR= PRIORITY

RR= ROUND ROBIN

BN= BINARY

BC= BCD

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Using the Main Menu

There are three selections within the main menu. They are:

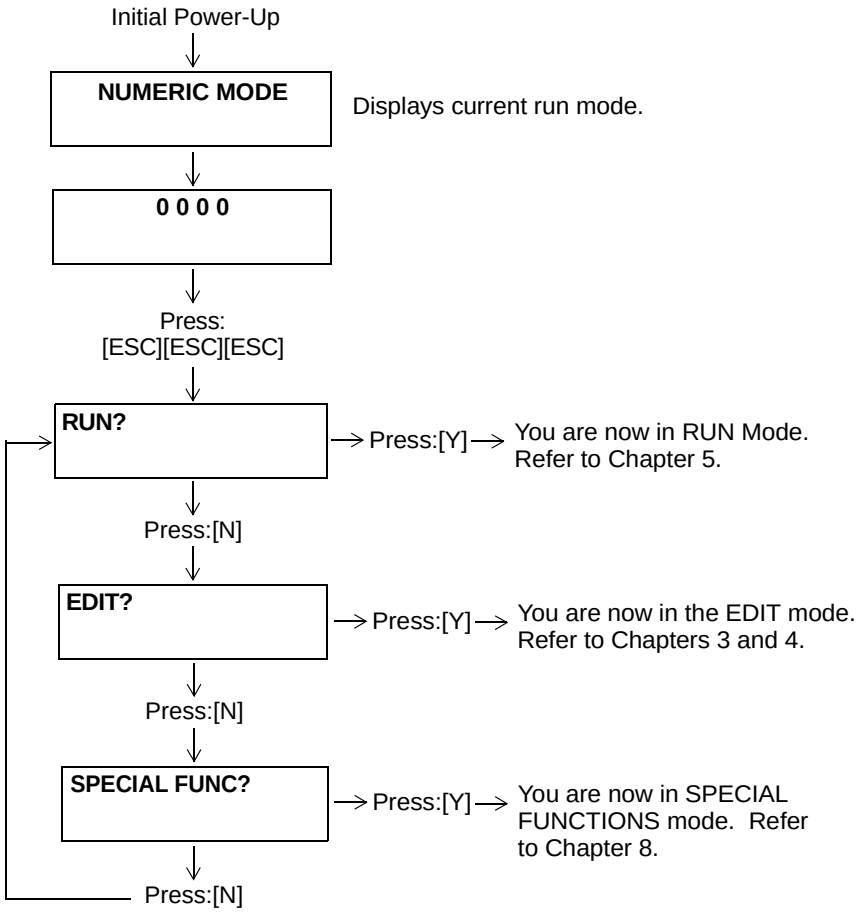
1) RUN. While in the run mode, the DL5 accepts message trigger commands or real time variables (data) from the controller and then displays the appropriate message or data.

2) EDIT. Answering Yes to Edit allows you to create new messages or modify old messages.

3) SPECIAL FUNCTIONS. The special functions selection allows you to access special routines such as debug or memory clear functions. It also allows set up of the parallel, and serial ports as well as selection of a run mode.

Answering [Y] to one of these main menu prompts will allow access to additional prompts pertaining to that selection. If you press the [N] (No) key and then the [Retrn] key, the prompt for the next main menu selection will be displayed. Refer to the following flow chart of the main menu:

Main Menu Flow Chart



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Returning to the Main Menu

Most functions (except Run) will return you to the main menu when they have been completed. However, you can return to the main menu at any time by simply pressing the [Esc] key three consecutive times. When executed from the Run or Special Functions Modes, this will return you to the RUN? prompt of the main menu. However, when in the Edit Mode pressing the [Esc] key three consecutive times will return you to the Edit? prompt of the Main Menu. You will not lose any data or messages that have been previously entered when you press the [Esc] key.

Using the Control Key

To access certain special functions of the DL5, you may be required to use the [Ctrl] key in conjunction with another key. There are some variations in how you use the control key depending upon the type of terminal or computer you are using to program the DL5. Most terminals or computers will require you to hold down the [Ctrl] key and then press a second key.

Note: If you are using an Allen-Bradley Industrial Terminal (Catalog No. 1771-T1, -T2, -T3, or -T4), you must press and release the [Ctrl] key prior to pressing the next key.

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Entering New Messages

Chapter Objectives

In this chapter you will learn:

- How to assign attributes to a message. Message attributes define how a message will be displayed.
- How to enter messages.

Edit vs. Run Mode

Using the DL5 is a three step process:

1. First, messages are entered into the DL5's memory while in the edit mode.
2. Next, the run mode, autorun message, and operating characteristics of the serial and parallel ports are selected using the special functions menu.
3. Finally, the DL5 is put in the run mode. In the run mode external devices trigger the DL5 to display stored messages or real time variables. The attributes selected for each message, such as *flash message*, *scroll*, etc. will control how each message is displayed.

Selecting the Edit Mode

You can either enter a new message or edit an existing message by selecting the edit mode. You select the edit mode by pressing the [Y] key in response to the EDIT? prompt.

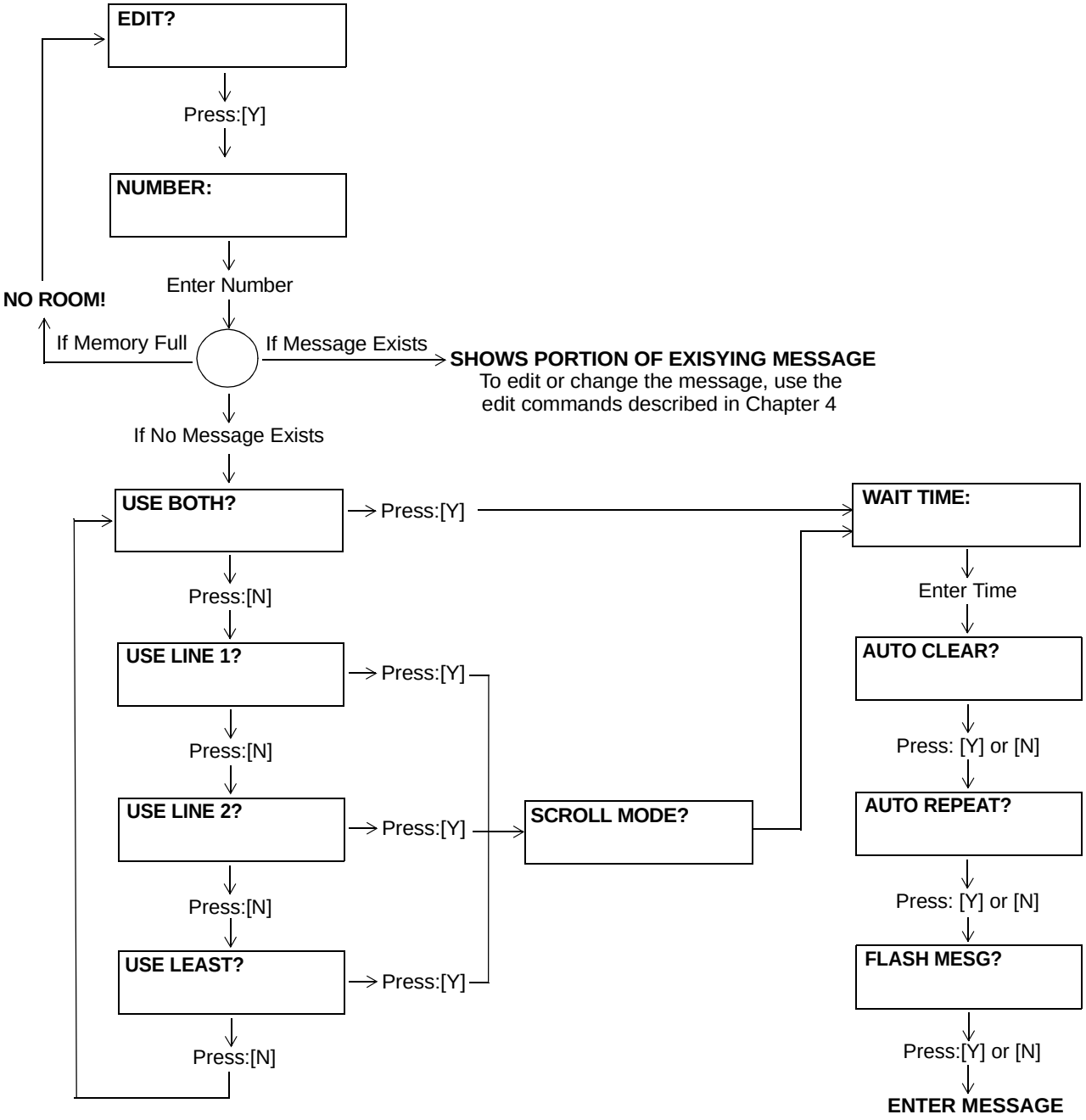
Note: To get the EDIT? prompt from the RUN mode, press [Esc] three times, answer [N] to RUN?, and press [Retrn].

Once you have entered the edit mode, the DL5 will display a series of prompts. Refer to the next page for a flow chart of the edit mode menu.

Important: Menu shown is for a 2 line DL5. One line displays do not have the prompts (USE BOTH?, USE LINE 1?, USE LINE 2?, USE LEAST?).

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Edit Mode Menu



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Specifying Message Attributes

After you have entered the edit mode and selected a new message number to edit, you must specify the message attributes. The message attributes determine how the message is displayed. The DL5 prompts for each attribute, one at a time. You must respond to all the attribute prompts that are displayed.

Note: If any attribute setting is changed and then the [Esc] key is pressed three times, the changed attribute is not saved. It is necessary to carriage return through all attribute settings to change one of them.

Some message attributes are mutually exclusive; you can select either one, but not both. Refer to the edit menu diagram (previous page) and the following descriptions when specifying message attributes.

Line Selection

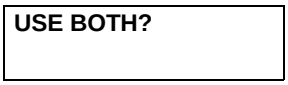
If you are using a single line DL5, there are no line selection prompts and you should refer to the next section.

If you are using a two line DL5, the first message attribute that you must specify is the line, or lines, that the message will be displayed on. There are four options:

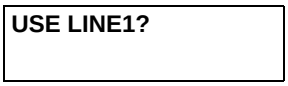
- 1) USE BOTH
- 2) USE LINE 1
- 3) USE LINE 2
- 4) USE LEAST

As the DL5 (two line only) displays a line selection prompt, you must respond with either a [Y] (Yes) or [N] (No) response. If you respond to a prompt by pressing the [Y] key followed by the [Retrn] key, the message attribute is entered into the memory of the DL5. If you respond by pressing the [N] key followed by the [Retrn] key, the next line selection option will be displayed. The following sections describe what effect each option has on the displayed message.

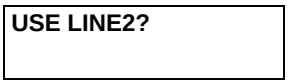
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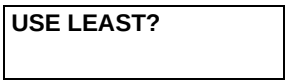
Selecting the USE BOTH option will automatically display the message on both lines of the display as a line mode message. A multi-line message will display with the first line of the message on the first line of the display. The next line of the message is displayed on the second line of the display. If the message is longer than the number of lines of the display, the DL5 will wait for the "wait time," and then show the remaining lines of the message.



The USE LINE 1 option displays the message only on the first (top) line of the display. Any messages present on the second line (if any) will remain intact.



The USE LINE 2 option displays the message only on the second line of the display. Any messages present on the first line of the display (if any) will remain intact.



The USE LEAST option displays the message on the least recently used line (oldest line of information). Any messages present on the other line of the display (if any) will remain intact.

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Selecting Line or Scroll Mode

If you are using a single line DL5, the first prompt you will see displayed is the prompt for the line or scroll mode option. The prompting for line or scroll mode will also be displayed if you are using a two line DL5 and you did not choose the USE BOTH display option. The prompt will appear like this:

```
SCROLL MODE?
```

If you do not select the SCROLL MODE option, the line mode will be automatically selected.

- Scroll Mode – A scroll mode message scrolls across the display one character at a time. Characters enter from the right side of the display and exit on the left.

- Line Mode – A line mode message is displayed one message block (16 characters) at a time. Many of the messages that you create may be more than one block long. If a message is made up of more than one message block, the DL5 will display a message block for the specified wait time and then display the next blocks of the message.

Remember: If you are using a two line DL5 and selected the BOTH LINES option, the line mode will be selected automatically. You will not be prompted for the SCROLL MODE option.

Selecting Message Wait Time

The next message attribute that you must select is the message wait time. The message wait time controls how long a message or a portion of a message is displayed. The prompt for the message wait time appears like this:

```
WAIT TIME:
```

You must enter a wait time value between 0 and 15. The unit of time being selected depends upon whether line or scroll mode was chosen.

- If the scroll mode has been selected, the wait time is the amount of time that elapses before the next character is scrolled on the display. The unit of time is in tenths of a second.

- If the line mode has been selected, the wait time is the amount of time that a message block is displayed. The unit of time is in seconds.

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Auto Clear Option

The next prompt that you must respond to controls whether or not the display will clear after the message is shown. The prompt appears like this:

```
AUTO CLEAR?
```

If you select the AUTO CLEAR option, the DL5 will clear the display after the message has been displayed for the requested wait time. If you do not select the AUTO CLEAR option, the last block of the message will remain on the display until it is replaced with another message.

Auto Repeat Option

The next prompt that you must respond to allows a message to be repeated indefinitely. The prompt for the AUTO REPEAT option appears like this:

```
AUTO REPEAT?
```

If you select the AUTO REPEAT option, the message continually re-triggers itself after it completes its display. If you do not select the AUTO REPEAT option, the DL5 will display the message only once for every message trigger that is received.

Note: The AUTO REPEAT function will only work with message triggers that are in either binary or Binary Coded Decimal (BCD) format. The function will not work when the DL5 is in the round robin or priority mode of operation.

Flash Message Option

The last prompt determines whether or not the message flashes:

```
FLASH MESSAGE?
```

Selecting the FLASH MESSAGE option will cause the message to flash once per second while it is being displayed. After you respond to the FLASH MESSAGE prompt, the DL5 will display a flashing cursor. You can now enter a message.

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Default Values for Message Attributes

All of the message attributes have default values. The first time you enter a message into a new DL5, or one which has had its memory cleared, the DL5 specifies a default value. From then on, the default values for a new message are the same as the previous message you entered. This feature allows you to quickly enter a number of messages when all of the messages have the same or similar attributes.

Entering a Message

After you have specified all the attributes for a message, you can now enter the actual message. The DL5 stores messages in blocks of 16 characters. A message may be more than one block in length. The number of blocks that comprise a message is limited only by the amount of memory available. After you have specified a message's attributes, the DL5 will inform you that a new message can be entered by flashing an asterisk shaped cursor:



Note: You can edit the message being entered, or any previously entered message, by using the edit commands. Chapter 4 describes how to use the edit commands.

You can now enter your message. As you type, notice that the cursor moves towards the right side of the display as characters are entered. If the cursor reaches the first character segment on the right, the next character that you enter will position the cursor back at the first character segment on the left. For example, a new message is to be entered on a two line DL5 display (16 characters in a block). The DL5 will position the cursor at the first character position on the left:



If the message <Motor Starter #> is entered, the display will appear like this:



If the number <1> is entered at the last character position, the cursor will move to the first character segment on the left. The display will appear like this:



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If you would enter any additional characters, the original characters would be overwritten with new characters. If you would type in <Allen–Bradley> the message would appear like this:

```
ALLEN-BRADLEY*#1
```

If you want to enter a message that is comprised of more than 16 characters (one block) in length, you must press the [Ctrl] and [J] keys simultaneously after the first message block is entered. The DL5 will then move the cursor to the beginning of the next block of text. For example, if you wanted to enter the message "Feed Conveyor Is On" you would need at least two message blocks to enter the message. First you would enter the first part of the message <Feed Conveyor>. The DL5 will display:

```
FEED CONVEYOR*
```

You would then select the next message block by pressing the [Ctrl] and [J] keys. The DL5 will display:

```
*
```

You can now enter the second block of the message <IS ON>. The DL5 will display:

```
IS ON*
```

Note: If you press the [Ctrl] and [J] keys simultaneously at the end of a message, a blank message block at the end of the message will be created. The blank message block will be displayed for the specified wait time. This can cause apparent delays between messages when the display is in the run mode. Do not type [Ctrl] [J] at the end of a message.

Now when the message is triggered, a two line DL5 will display the message:

```
FEED CONVEYOR
IS ON
```

After you have finished entering your message, you can return to the EDIT? prompt in one of two ways:

- You can press the [Esc] key three times.
- You can press the [Ctrl] and [Q] keys to select the quit function.

Embedding Numeric Variable Data in a Message

Numeric variable data can be inserted in a message. Refer to Chapter 9 which describes how to use the variable data feature.

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Entering a Sample Message

The quickest way to learn how to use the DL5 is to enter some messages. This section provides instructions on entering a sample message.

Note: Default values will appear on all of the message attribute prompts. If the default value is the desired response, press the [Retrn] key to accept the default value. If necessary, refer back to Chapter 3 descriptions of default values.

To enter the sample message, perform the following steps:

1. Make sure that the DL5 is displaying the following prompt:

```
EDIT?
```

Note: To get the EDIT? prompt from the RUN mode, press [Esc] three times, answer [N] to RUN?, and press [Retrn].

2. Press the [Y] and [Retrn] keys to enter the edit mode. The DL5 will display:

```
NUMBER:    0
```

3. Enter a message number that does not presently exist and then press the [Retrn] key. The DL5 will display one of two prompts depending upon the type of display (one or two line) that you are using.

If you are using the two line version of the DL5, the following will be displayed:

```
USE BOTH?
```

Proceed to Step 4

If you are using the one line version of the DL5, the following will be displayed:

```
SCROLL MODE?
```

Proceed to Step 6

4. Press the [N] and [Retrn] keys in response to the USE BOTH? prompt. The DL5 will display:

```
USE LINE1?
```


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5. Press the [Y] and [Retrn] keys in response to the USE LINE 1? option. The DL5 will display:

SCROLL MODE?

6. Press the [N] and [Retrn] keys in response to the SCROLL MODE? prompt. This will select the message to be displayed in the line mode. The DL5 will display:

WAIT TIME:

7. You want each block of the message to be displayed for three seconds. Press the [3] and [Retrn] keys to select a wait time of 3. The DL5 will display:

AUTO CLEAR?

8. You want the message to be cleared from the display after the selected wait time has elapsed so press the [Y] and [Retrn] keys. The DL5 will display:

AUTO REPEAT?

9. The message that is being entered will only be displayed once per trigger, so press the [N] and [Retrn] keys. The DL5 will display:

FLASH MESG?

10. You want the message to flash, so press the [Y] and [Retrn] keys to select the flashing message option. The DL5 will display a flashing cursor which indicates that a new message can be entered.

11. Enter the message <HOLDING TANK #1>. The message will appear on the display:

HOLDING TANK#1*

12. Press the [Ctrl] and [J] keys to move the cursor to the next block of the message. The DL5 will display the cursor at the first character position in the second block of the message.

*

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13. Enter the second part of the message <IS FULL>. The message will appear on the display:

```
IS FULL*
```

14. You have completed entering the message. You can see how the message will appear when triggered by pressing the [Ctrl] and [R] keys simultaneously. The DL5 will flash the first block of the message for approximately three seconds. And then the DL5 will display the second block of the message for three seconds:

Note: Chapter 4 describes this and other methods of reviewing a message.

15. Return to the EDIT? prompt by pressing the [Ctrl] and [Q] keys or by pressing the [ESC] (Escape) key 3 times.

Programming Multiple DL5s Identically

A quick method of programming multiple displays with identical messages is to use the DL5 Series Off-line Programming Software (Catalog No. 2706-NP5). Instructions on using the software are provided with the software package. The software can be run on IBM PC or compatible computers with 3 $^{1}/_{2}$ inch disk drives. This includes Allen-Bradley RAC 6000 industrial computers.

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Reviewing and Editing Messages

Chapter Objectives

This chapter describes how to review and edit existing messages using DL5 edit commands. Using a programming terminal, you can display a previously entered message as it would normally be displayed in the run mode. To display a message:

Reviewing a Message

1. Make sure the following prompt is displayed:

   ```
   EDIT?
   ```

   To get the EDIT? prompt from the Run mode, press [Esc] three times, answer [N] to RUN? and press [Retrn].

2. Press the [Y] and [Retrn] keys to enter the edit mode. The DL5 will display:

   ```
   NUMBER = 0
   ```

3. Enter the message number of the message you want to review and then press the [Retrn] key. The DL5 will display the first block of the message.

4. Press the [Ctrl] and [R] keys simultaneously. The DL5 will then display the message as it would appear with all its selected attributes.

5. After displaying the message, the DL5 will return to showing a portion of the message. The DL5 is still in the edit mode. You can now edit the message using the techniques described in this chapter or you can exit the edit mode by pressing the [Ctrl] and [Q] keys simultaneously. The DL5 returns to the EDIT? prompt.

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Displaying the Amount of Memory Remaining

You can command the DL5 to display the amount of memory (message blocks) remaining for new messages or additions to existing messages. To display the number of message blocks remaining, press the [Ctrl] and [F] keys simultaneously while the display is in the edit mode showing part of a message. The DL5 will display:

```
FREE SPACE 0020
```

The number that is displayed is the number of message blocks remaining. Each message block can contain 16 characters.

After two seconds, the DL5 will automatically return to the same block of the message that was being displayed prior to the [Ctrl] [F] function.

The table below lists the commands available for your use. Use this table as a quick reference for the DL5 commands.

DL5 Edit Commands

Keys Pressed	Command Function
[Ctrl] [A]	Allows access to previously entered message attributes so they can be reviewed or changed.
[Ctrl] [C]	Centers a message on the display.
[Ctrl] [D]	Deletes a single message block.
[Ctrl] [E]	Erases an entire message.
[Ctrl] [F]	Shows the number of free message blocks remaining.
[Ctrl] [H]	Moves the cursor one character position to the left.
[Ctrl] [I]	Inserts a message block between two previously entered message blocks.
[Ctrl] [J]	Creates a new message block after previously entered message blocks or moves the cursor one message block towards the end of the message.
[Ctrl] [K]	Moves the cursor one message block towards the beginning of the message.
[Ctrl] [L]	Moves the cursor one character position to the right.
[Ctrl] [Q]	Exits the edit mode with save.
[Ctrl] [R]	Runs a message in the edit mode.
[Ctrl] [V]	Embeds a single digit variable in a message. Displays the data without leading zeros.
[Ctrl] [X]	Imbeds a single digit variable in a message with leading zeros.

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Selecting a Message to Edit

To edit a previously entered message, perform the following steps:

1. Make sure the following prompt is displayed.

```
EDIT?
```

   Note: To get to the EDIT? prompt from the Run Mode, press [Esc] three times, answer [N] to RUN? and press [Retrn].

2. Press the [Y] and [Retrn] keys to enter the edit mode. The DL5 will display:

```
NUMBER:  0
```

3. Enter the message number of the message that you want to edit and then press the [Retrn] key.

The DL5 will then display a portion of the message you want to edit. You can now edit the message using the edit commands.

Moving the Cursor

All editing activity occurs at the cursor position. To edit a message, you must first position the cursor at the characters that are to be changed. The following commands are used to position the cursor.

Forespace [Ctrl] [L]

This command moves the cursor one character position to the right. You select the forespace command by pressing the [Ctrl] and [L] keys. If the cursor is already at the last character position, the cursor will move to the first character position on the left side of the display.

Note: Many types of terminals have a forward arrow key. This key will often generate the [Ctrl] [L] command.

Backspace [Ctrl] [H]

This command moves the cursor one character position to the left. You select the backspace command by pressing the [Ctrl] and [H] keys. If the cursor is already at the first character position in the message the cursor will move to the last character position.

Note: Many types of terminals have a back arrow or a [BACKSPACE] key. Both of these keys will often generate the [Ctrl] [H] command.

Forward One Message Block [Ctrl] [J]

This command moves the cursor one message block towards the end of the message. If the cursor is already at the last message block in a message, the command will create a new message block directly after the previous message block. You select the forward one message block command by pressing the [Ctrl] and [J] keys.

Note: Do not type [Ctrl] [J] after the final message block has been entered. A blank message block will be created and displayed as part of the message.

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Back One Message Block [Ctrl] [K]

This command moves the cursor one message block towards the beginning of the message. If the cursor is already at the first message block in the message, the DL5 will ignore the command. You select the back one message block command by pressing the [Ctrl] and [K] keys.

Deleting a Character

You can delete a character by typing in a new character directly over the old character. If you want to delete a character and replace it with a blank space, use the [SPACE] key.

You can delete an entire message block by pressing the [SPACE] key repeatedly until all of the characters are replaced with blank spaces. However, the message block will not be deleted from memory.

Deleting a Message Block

You can delete an entire block of a message by pressing the [Ctrl] and [D] keys. The delete message block command will delete all 16 characters in a message block. After you delete a message block, the DL5 will then display one of three items:

- If you deleted the first message block in a multiple block message, the DL5 will display the second block of the message.
- If you deleted any message block, other than the first message block in a multiple block message, the DL5 will display the previous message block.
- If you deleted the only message block in a single block message, the entire message is deleted and the DL5 will display the EDIT? prompt.

For example, assume that the DL5 contains the following message which is stored in three separate message blocks:

PRESSURE IN	RESERVOIR TANK	IS NORMAL

Assume the cursor is positioned at the first character in the second message block. The DL5 display will appear like this:

*ESERVOIR TANK

If the [Ctrl] and [D] keys are now pressed, the message block RESERVOIR TANK will be deleted. The message now contains just two message blocks:

PRESSURE IN	IS NORMAL

The DL5 displays the message block that was preceding the deleted message block:

*RESSURE IN

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Inserting a Message Block

You can insert a message block (if free message blocks are available) between two previously existing message blocks by pressing the [Ctrl] and [I] keys. The new message block is inserted after the message block that was being displayed when the insert message block command was pressed.

For example, assume that the DL5 contains the following message which is stored in two separate message blocks:

CONVEYOR BELT	HAS STOPPED

Assume that the cursor is positioned at the first character in the first message block. The DL5 display will appear like this:

```
*ONVEYOR BELT
```

Note: The cursor does not have to be in the first character position.

If the [Ctrl] and [I] keys are now pressed, a new message block will be created after the first message block. The DL5 will display:

```
*
```

If the message <IN SHIPPING> is entered in the new message block, the message would now contain three message blocks:

CONVEYOR BELT	IN SHIPPING	HAS STOPPED

Deleting an Entire Message

You can quickly delete an entire message from memory by pressing the [Ctrl] and [E] keys. The command will erase all of the message blocks contained in a message.

For example, assume that the DL5 contains the following message which is stored in two message blocks:

HOPPER #2	IS EMPTY

Assume that the cursor is positioned at the first character position in the second message block. The DL5 display will appear like this:

```
*S EMPTY
```

If the [Ctrl] and [E] keys are now pressed, the DL5 will first display:

```
SURE?
```

Next the [Y] and [Retrn] keys must be pressed to confirm that the message is to be deleted. The DL5 will delete the message and then display:

```
EDIT?
```


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Editing Message Attributes

To edit the previously entered attributes of a message, perform the following steps:

1. Make sure the following prompt is displayed:

   ```
   EDIT?
   ```

   Note: To get to the EDIT? prompt from the Run Mode, press [Esc] three times, answer [N] to RUN?, and press [Retrn].

2. Press the [Y] and [Retrn] keys to enter the edit mode. The DL5 will display:

   ```
   NUMBER:  0
   ```

3. Enter the message number of the message you want to edit and then press the [Retrn] key. The DL5 will display a portion of the message.

4. Press the [Ctrl] and [A] keys.

   – If you are using a one line display, the DL5 will display:

   ```
   SCROLL MODE?
   ```

   – If you are using a two line display, the DL5 will display:

   ```
   USE BOTH?
   ```

5. You can now change message attributes by entering new [Y] or [N] responses to the message attribute prompts and then pressing the [Retrn] key. Or you can keep the original attributes by pressing the [Retrn] key. The attribute prompts will appear in the same sequence as when they were first entered.

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Run Mode

Chapter Objectives

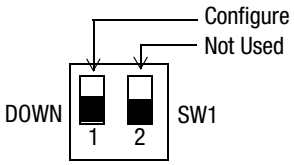
This chapter describes how to enter and exit run mode. You will also learn how the DL5 operates while in run mode.

Entering Run Mode

Run Mode - Parallel Operation

To enter run mode for parallel operation:

1. Make sure the Serial Trigger / Configure DIP switch (SW1-1) is in the DOWN (Configure) position.



2. Check that the following prompt is displayed:

```
RUN?
```

   Note: To get the RUN? prompt from the Special Functions Mode, press [Esc] three times. From the Edit Mode, it is also necessary to answer no to Edit? and Special Functions?

3. Press the [Y] and [Retrn] keys to enter the run mode. The DL5 will display either a blank screen or a selected autorun message. Chapter 8 describes the autorun message and how the autorun message is selected.

   The DL5 is now in the run mode and will display any messages that are triggered by the control system.

To exit the parallel run mode:

Press the [Esc] key three times. The DL5 displays the following prompt when run mode is terminated:

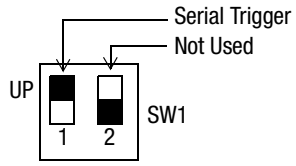
```
RUN?
```


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Run Mode - Serial Operation

To enter the serial triggering run mode:

Move the DIP switch (SW1-1) to the UP (serial trigger) position.



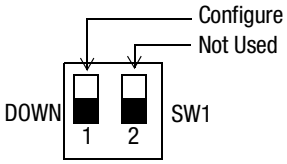
This immediately switches the DL5 from the edit to run mode. The operation of the serial port changes from programming to serial message triggering.

Note: Any message edits or menu entries are terminated when the DIP switch position is changed.

After entering the serial trigger mode, the standard startup screens are displayed followed by the autorun message. The DL5 will then interpret any serial data as a message trigger command.

To exit the serial triggering run mode:

Move the DIP switch (SW1-1) to the Down (configure) position.



This switches the DL5 from the run to edit mode. The operation of the serial port changes from serial message triggering to programming. The following is displayed after exiting the serial triggering mode:

```
RUN?
```

With the DIP switch in the Configure position, any serial data is interpreted as a menu or edit command.

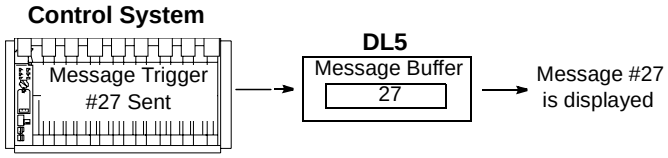
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Description of Run Mode

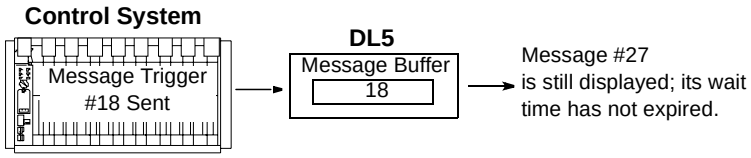
In the run mode, the DL5 waits for the host to send message triggers and/or variable data. The DL5 receives message triggers and variable data through either the parallel or serial port. The serial and parallel ports cannot be active at the same time. The Serial Trigger/Configure DIP switch determines the active port (Serial Trigger position = serial port, Configure position = parallel port). When a message trigger is received, the DL5 searches its memory for the selected message, inserts any imbedded variables, and then displays the message.

If another message trigger is sent to the DL5 before the first message's wait time has expired, the DL5 stores the message trigger in a message buffer. The capacity of the message buffer is one message. Refer to the following example which shows how the message buffer operates.

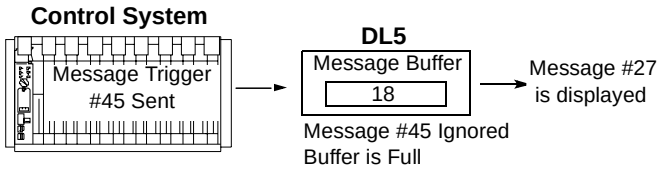
1. The host controller sends a message trigger for message number 27 to the DL5. The DL5 removes the message trigger from the message buffer and displays message number 27.



2. While the DL5 is displaying message number 27, the DL5 receives a message trigger for message number 18. The message trigger is stored in the message buffer.

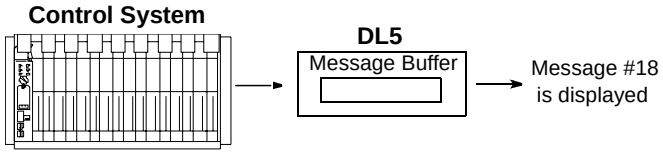


3. The DL5 receives an additional message trigger for message number 45, while message number 27 is still displayed. Since the message buffer already contains a message trigger, the trigger for message number 45 is ignored.



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4. After the DL5 completes the display of message number 27, the DL5 removes the message trigger for message number 18 from the message buffer and then displays message number 18. The message buffer is now ready to accept another message number.



Note: While in the priority or round robin modes of operation, the DL5 does not store message triggers in the buffer.

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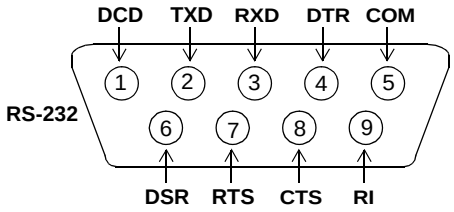
Using the Serial Port

Chapter Objectives

The DL5 has a full duplexed RS-232 serial port which is used for:

- communication with the offline programmer and for programming input from a “dumb” ASCII terminal.
- serial triggering of messages

The operation of the serial port is determined by the Serial Trigger/ Configure DIP switch on the back of the DL5 see page 2-2. The RS-232 serial port is a 9-pin male D-shell connector located at the rear of the DL5. A drawing of the DL5’s connector is provided below:



The RS-232 port operates at baud rates of 300, 1200 and 9600 baud. The rate is user selectable through the Special Functions Menu or the Offline Programmer. The default baud rate of the DL5 is 9600 baud.

Programming Cables

Cables are available to connect various programming devices. The following table lists the cable to use with various terminals or computers:

Serial Cable Catalog Number	Description
2706-NC12	Personal computers with 25-pin female communication port connector. DEC VT52, VT100, or VT101 terminals. Allen-Bradley RAC 6000 industrial computers.
2706-NC13	Personal computers with 9-pin female communication port connector (IBM AT and compatible). Allen-Bradley RAC 6000 industrial computers.
2706-NC14	Allen-Bradley RAC 6000 industrial computers (PC/XT).
2706-NC15	Allen-Bradley Industrial Terminals T1 through T4 (25-pin male connector).

See Appendix B for cable diagrams and descriptions.

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RS-232 Signals

The DL5's RS-232 port uses Transmit Data signal, Receive Data signal, and Signal Common. The Clear To Send, Data Carrier Detect, and Data Set Ready pins are tied high (+12V) by the DL5, allowing direct connection of the DL5 to terminals or computers requiring a request to send signal. No jumpers at the terminal or computer connector should be required.

Pin Number	Signal Name (Signal Mnemonic)	Signal Type
1	Data Carrier (DCD)	Output
2	Transmit (TXD)	Output
3	Receive Data (RXD)	Input
4	Data Terminal Ready (DTR)	Input
5	Signal Common (COM)	--
6	Data Set Ready (DSR)	Output
7	Request to Send (RTS)	Input
8	Clear to Send (CTS)	Output
9	Ring Indicator (RI)	Output

Data Carrier Detect - Pin 1 Indicates that a continuous frequency "capable of being modulated or impressed with a signal" is being received. The DL5 sets this line high.

Transmit Data - Pin 2 Sends out the serialized data from the DL5 (e.g., the serial data is on this pin).

Received Data - Pin 3 This signal also carries serial data. However, the serialized data is sent from another device as input to the DL5.

Data Terminal Ready - Pin 4 Indicates the transmission device (terminal) is connected, powered up, and ready to send data. The DL5 ignores this line.

Signal Common - Pin 5 The ground reference for all other signals.

Data Set Ready - Pin 6 Indicates that a communications device is connected, powered up, and ready for data transmission. The DL5 sets this line high.

Request to Send - Pin 7 Signal from the terminal device requesting the communication device to send data. This typically turns on the data carrier. The DL5 ignores this line.

Clear to Send - Pin 8 This signal indicates to the transmitting device that it can start sending data. The DL5 sets this line high.

Ring Indicator - Pin 9 This signal indicates that each device is physically connected to adjacent devices. The DL5 sets this line high.

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Serial Port Protocol

When the DL5 is set to be triggered through the serial port, use the following protocols to trigger messages and display variable data:

Message Trigger [Ctrl][T]

Use the CTRL-T command to trigger messages while the DL5 is in the binary and BCD modes. The message number and address are decimal values. The command has the following format:

CTRL-T	Message Number	\ Backslash	DL5 Address	Carriage Return

where:

- Message Number is a decimal value in the range 1-999
- DL5 Address is a decimal value in the range of 0-127

For example, to trigger Message #123 on a DL5 with an address of 10, the following string would be sent:

ASCII	^T	1	2	3	\	1	0	^M
HEX	14	31	32	33	5C	31	30	0D

Note: If you need to trigger messages (Round Robin and Numeric modes), with a PLC that does not support unsigned integers, refer to the application note in Appendix D

Note: If the DL5 is in serial trigger mode and you attempt to download messages using the offline programming software, data corresponding to a message trigger command will be executed.

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Variable Data [CTRL][V]

Use the CTRL-V command to send data for display in Binary, BCD, Numeric, Priority, and Round Robin modes. All values are decimal values. The command has the following format:

CTRL-V	Variable Data	\ Backslash	Variable Position	\ Backslash	DL5 Address	Carriage Return

where:

- Variable Data is 1 to 5 ASCII digits (0-65535)
- Variable Position is single ASCII digit (value is ignored)
- DL5 Address is 1 to 3 ASCII digits (0-127)

For example, to send a value of 500 to a DL5 with an address of 99, the following string would be sent:

ASCII	^V	5	0	0	\	1	\	9	9	^M
HEX	16	35	30	30	5C	31	5C	39	39	0D

Note: In Binary mode, variable data can be in the range 0 to 16,383. In BCD mode, variable data must be in the range 0 to 3999. In Round Robin and Numeric modes, variable data can be in the range of 0 to 65535.

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Using the Parallel Port

Chapter Objectives

This chapter provides:

- A description of the parallel port.
- Data format requirements for parallel input.
- Descriptions and examples of message triggering.
- Parallel port interface examples.

Note: This chapter describes how you can use the parallel port to trigger messages. If you require information on how to input variable data, refer to Chapter 9.

Description of the Parallel Port

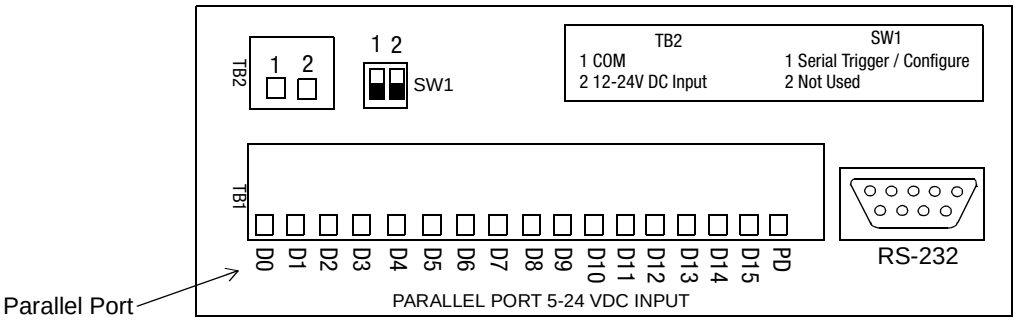


ATTENTION: The DL5 only has single direction communications (receives data, cannot send data). Do not use the DL5 for critical display applications. Single direction communications does not provide verification that messages sent by the control system have been received and displayed by the DL5.

You can use the parallel port of the DL5 to trigger messages and to input variable data. The parallel port is located on the back of the DL5. The parallel port terminals (TB1) are labeled as shown on the next page.

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Parallel Port Connections (TB1)

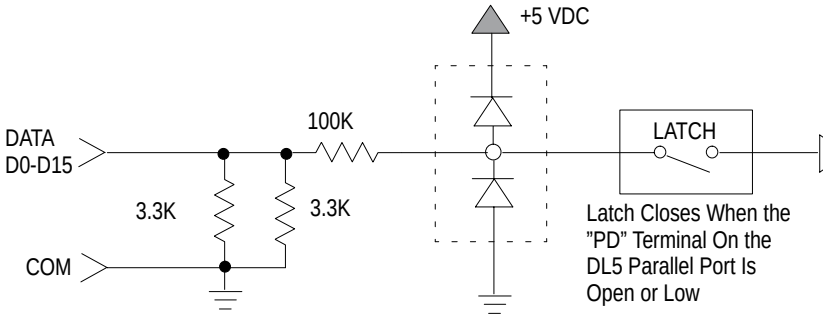


- Terminals D0 through D15 are for message number and data input.

- Terminal PD is for the enabling or disabling of the parallel port. If PD is tied high, the port is disabled and the DL5 will ignore data on data lines D0-D15. If PD is low, the port is enabled and the DL5 will read and respond to data on data lines D0-D15. As long as PD is controlled separately, using PD will allow multiple DL5's to be connected to one set of outputs (multiplexed).

- The input voltages for terminals D0 through D15 and PD can vary from 5 to 24 volts DC. The figure below shows a circuit diagram of an input terminal.

Parallel Port Input Circuit



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Selecting BCD or Binary Data Format

The parallel port will accept data and message triggers in either a binary or Binary Coded Decimal (BCD) format or in non-coded discrete form which allows the DL5 to easily replace pilot lights as described in Chapter 10.

Each numbering system, binary or BCD, has its own merits. Your choice will often be based upon the format used by your controller. Both the binary and BCD numbering systems allow you to address all 999 possible message numbers but vastly different maximum variable values. The maximum variable value that can be input in binary or BCD run modes is shown below:

Run Mode	Maximum Message #	Maximum Variable Value
BCD	999	3,999
Binary	999	16,383

You must select which format best suits your needs and then select the run mode as described in Chapter 8.

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Using Binary Data Input

In the binary (Run) mode, the DL5 interprets data on terminals D0 through D13 as binary data. Terminals D14 and D15 are the strobe lines. Terminal D0 represents the least significant digit and D13 represents the most significant digit. A data line may either be at ground level, which represents a binary value of 0, or a data line may have a voltage present, which represents a binary value of 1.

The convention of having a voltage represent a value of 1 and ground representing a value of 0, is known as positive binary logic (high true logic). The opposite convention is known as negative binary logic (low true logic). You can set the DL5 to accept either positive or negative logic (high or low true), refer to Chapter 8. The following table shows the value of each data line. Selecting the binary data run mode is explained in Chapter 8.

Binary Values of the Data Lines

Data Line	Value When On (True)	Data Line	Value When On (True)
D0	1	D8	256
D1	2	D9	512
D2	4	D10	1,024
D3	8	D11	2,048
D4	16	D12	4,096
D5	32	D13	8,192
D6	64	D14	Strobe Line
D7	128	D15	Strobe Line

The table below shows the control functions of the strobe lines:

D14	D15	Function
High or Low	High	Indicates that binary value on D0 through D13 represents a message number.
High	Low	Indicates that binary value on D0 through D13 represents variable (numeric) data.
Low	Low	Binary value on D0 through D13 is ignored.

Example: Assume that the following logic levels (positive logic) appear on the data lines.

Data Line:	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Logic Level:	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0
Value:	1	0	0	0	16	0	0	128	0	0	0	0	4,096	0	0	0

Adding the values of the individual data lines provides the value being entered, in this example 4,241. Since strobe line D14 is high (voltage present) and D15 is low (ground level), this value is interpreted as variable data.

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Using BCD Data Input

The fourteen data lines can also be used to input BCD formatted data. The BCD numbering system uses a group of four data lines to represent a single decimal digit. The table below shows the value of each data line. Selecting the BCD run mode is explained in Chapter 8.

BCD Values of the Data Lines

Data Line	Value When On (True)	Data Line	Value When On (True)
D0	1	D8	100
D1	2	D9	200
D2	4	D10	400
D3	8	D11	800
D4	10	D12	1,000
D5	20	D13	2,000
D6	40	D14	Strobe Line
D7	80	D15	Strobe Line

Control functions of the strobe lines are the same for BCD data input as for binary data input.

For example, assume the following logic (positive logic) levels appear on the data lines.

Data Line:	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Logic Level:	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0
Value:	1	0	4	0	0	0	40	0	100	0	0	0	1,000	0	0	0

Adding the values of the individual data lines provides the value being entered, in this example 1,145. Again, D14 is high (voltage present) and D15 is low (ground level), so this number is interpreted as variable data.

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Logic Levels

The DL5's parallel port accepts DC inputs of 0-24 volts. These input voltages can be used to trigger messages or transfer variable (numeric) data. The DL5 interprets the voltages that are present on the data lines as either a "High" or "Low" condition. There is also a third state which should be avoided, an in between or indeterminate state. The indeterminate state occurs when the input voltage is between the "High" voltage range and the "Low" voltage range. The voltage ranges that the DL5 interprets as either "High" or "Low" values depends on whether positive or negative binary logic has been selected.

The table below lists the voltage ranges and their logic values.

Positive Logic Level	Negative Logic Level	Recognized Voltage Range	Indeterminate Voltage Range
High (True)	Low (True)	3.5 to 24V DC	0.9 to 3.5V DC
Low (False0	High (False)	0 to 0.9V DC	0.9 to 3.5V DC

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Using the Numeric (Run) Mode

In this mode, the DL5 interprets inputs into the parallel port only as BCD numeric data and immediately displays the BCD number. Only line 1 of the DL5 is used. Inputs to the first twelve terminals (D0 through D11) are always interpreted as three BCD digits. Inputs to the last four terminals (D12 through D15) are interpreted as a fourth BCD digit (if the input is a valid BCD code), or as a special instruction code (if the input is not a valid BCD code). The special instruction code allows you to define a destination on the DL5 display for the three BCD numbers on data lines D0 through D11. This allows a number as large as 15 digits, two 6 digit numbers, or three 3-digit numbers to be displayed on the DL5. The table below defines the special instruction codes of D12 through D15.

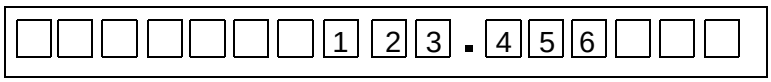
Numeric Mode Functions

D15	D14	D13	D12	Value	Function
0	0	0	0	0	Interprets input as a fourth BCD digit of the value given
0	0	0	1	1	
0	0	1	0	2	
0	1	0	0	3	
				4	
0	1	0	1	5	
0	1	1	0	6	
0	1	1	1	7	
1	0	0	0	8	
1	0	0	1	9	
1	0	1	0	-	Displays the three BCD digits (from inputs D0-D11) in the **first** 3 (leftmost) character positions.
1	0	1	1	-	Displays the three BCD digits (from inputs D0-D11) in the **second** character position from the left.
1	1	0	0	-	Displays the three BCD digits (from inputs D0-D11) in the **third** character position from the left.
1	1	0	1	-	Displays the three BCD digits (from inputs D0-D11) in the **fourth** character position from the left.
1	1	1	0	-	Displays the three BCD digits (from inputs D0-D11) in the **fifth** character position from the left.
1	1	1	1	-	Clears the display and sets decimal point.

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Example:

You want to display the following number and decimal point in the DL5:



You would send data to the parallel port in the following sequence:

1.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0

Clears the display and sets the decimal point.

And positions the decimal point 6 places from the right of the display.

2.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1

Directs BCD digits to third 3 character position.

And sends the BCD number 123

3.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	1	0	1	0	0	0	1	0	1	0	1	1	0

Directs BCD digits to fourth 3 character position.

And sends the BCD number 456

If an invalid BCD digit is received, the corresponding character position on the display will be blank. If the number setting the decimal point is zero, no decimal point is displayed. When the decimal point is used, it takes one character position on the display as shown in the examples.

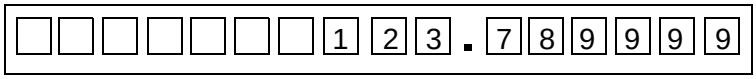
You can update the numbers on the display without clearing the display or resetting all digits. That is, to change three digits of a number, you send only those three digits, along with the appropriate special instruction code; the remaining digits are left unchanged.

Note: If you are changing all the numbers on the display, you should clear the entire display.

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Example:

You want to change the number in the previous example from 123.456 to 123.789999:



You would send data to the parallel port in the following sequence:

1.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	1	0	1	1	1	1	0	0	0	1	0	0	1

Directs BCD digits to overwrite the fourth 3 character position.

And sends the BCD number 789.

2.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	0	1	0	0	1	1	0	0	1	1	0	0	1

Directs BCD digits to third 3 character position.

And sends the BCD number 999.

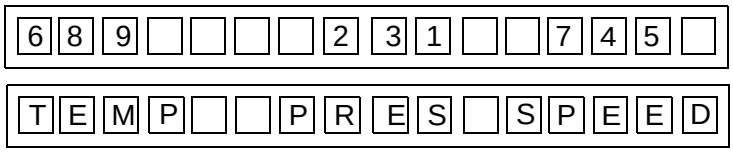
Note: No leading zero blanking is performed in the numeric mode. however, individual digits for D0 through D11 can be blanked by setting the input for that digit to a non-BCD value (greater than 9).

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Numeric Mode and Autorun Message

Using a two line DL5, the numeric mode can display an autorun message on line two in addition to the numeric data on line one. The autorun message is selected as described in Chapter 8. It should be programmed to appear on line two with autoclear set to NO. Each time the display enters the run mode or is powered up, the autorun message will appear on line two. The numeric data being sent will appear on line one.

Example:



This autorun message serves as a “legend” or “label” for the numeric variables.

When using the numeric mode, data must be held on the parallel port for 110 milliseconds (see page 7-13).

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Using DC Outputs to Trigger the DL5

There are two types of DC outputs:

- Hard contact outputs

  Hard contact outputs contain mechanically operated contacts. Examples of hard contact outputs include relays, push buttons, limit switches, and contact output modules such as Allen-Bradley's PLC module (Catalog No. 1771-OW) or SLC module (Catalog No. 1746-OW16). Any contact that does not have a leakage current while in the OFF state can be considered a hard contact device.

- Solid-state DC outputs

  Solid-state outputs do not have any mechanically operated contacts. All switching functions in a solid-state contact are done electronically. Examples are:

  PLC Modules
  – Catalog No. 1771-OB or -OBD

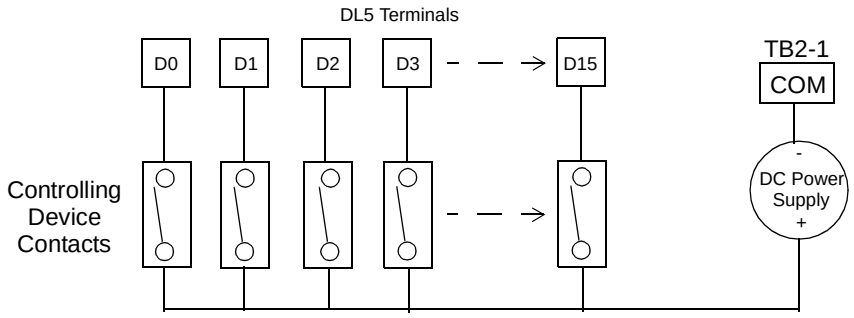
  SLC Modules
  – Catalog No. 1746-OV8, -OV16, -OV32

  – Catalog No. 1746-OB8, -OB16, -OB32

  – Catalog No. 1746-OG16

The figure below illustrates how DC outputs can be used to trigger the DL5.

Connecting DC Outputs to the DL5 Data Lines



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Determining Current Requirements For DC Outputs

You must check to make sure that the DC outputs supplying the parallel port can supply enough current to handle the requirements of the DL5's parallel port. The table below lists the current requirements for one DL5 parallel port input.

Parallel Port Typical Requirements for DC Outputs

5V DC Input	12V DC Input	24V DC Input
3.0 mA	7.3 mA	14.6 mA

To determine the total current requirements of the parallel port, multiply the number of inputs being used by the value found in the above table. For example: Assume that you are using 24 VDC outputs:

> Each input will draw a peak current of 14.6 milliamperes. If you are using all sixteen inputs, your output source must be able to provide 234 milliamperes of current (16 x 14.6 mA = 234 mA).

The table below lists the voltage and current requirements, per DL5 input, for various Allen-Bradley output devices.

Voltage and Typical Current Requirements Per DL5 Input

Output Type	Input Voltage	Input Current
1771-OB	12 or 24V DC	7.3 or 14.6 mA
1771-OBD	12 or 24V DC	7.3 or 14.6 mA
1771-OW	24V DC	14.6 mA
1746-OB	12 or 24V DC	7.3 or 14.6 mA
1746-OV	12 or 24V DC	7.3 or 14.6 mA
1746-OG	5V DC	3.0 mA

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Parallel Port Power Supply Requirements

The DL5 parallel ports require an input voltage source between 5-24 VDC with peak-to-peak noise and ripple less than 5% of the input voltage.

ATTENTION: To avoid ground loops, the same power supply that powers the display must be used to supply the parallel port.

Timing Requirements of the Parallel Port

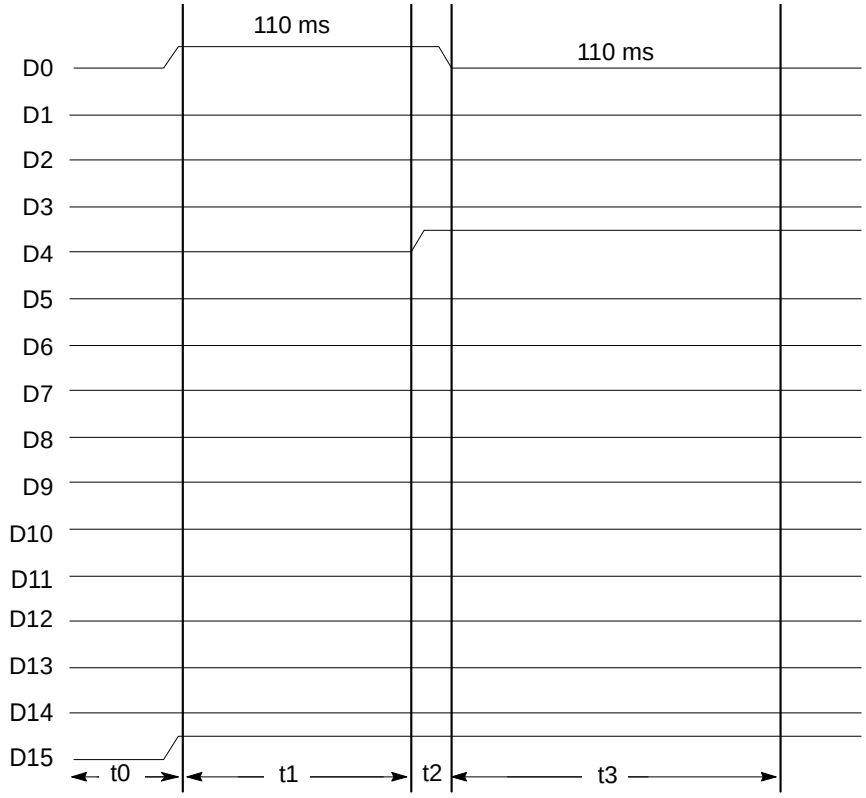
The DL5 reads (scans) the data lines periodically. You must ensure that the data is present on the data lines long enough to be read.

Note: Refer to Chapter 9 for a description of the timing requirements for messages with variable data.

In order to ensure that the data is read, the data must remain on the data lines for at least 110 milliseconds. After each scan the DL5 saves a copy of the data that was read. If the next scan reads the same data, the data is ignored. This feature prevents multiple triggering of the same message.

The figure below illustrates a typical message trigger sequence. Message #1 is triggered and then message #10 is triggered. In this example, the DL5 is set to accept BCD formatted codes (message or variable).

BCD Message Number Timing Example



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The following are descriptions of what occurs during each of the four timing intervals (t0, t1, t2, and t3):

During t0, the trigger for message No. 1 and strobe line D15 to indicate message number are placed on the data lines.

During t1, the message trigger and strobe are kept unchanged at the parallel port for a minimum of 110 milliseconds.

During t2, the trigger for message No. 10 and strobe line D15 to indicate message number are placed on the data lines, and the trigger for message number 1 is removed.

During t3, the message trigger and strobe are kept unchanged at the parallel port for 110 milliseconds.

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Special Functions

Chapter Objectives

In this chapter you will learn how to:

- set the electrical characteristics and operating mode of the parallel port
- use debug mode
- clear memory
- set the autorun message number

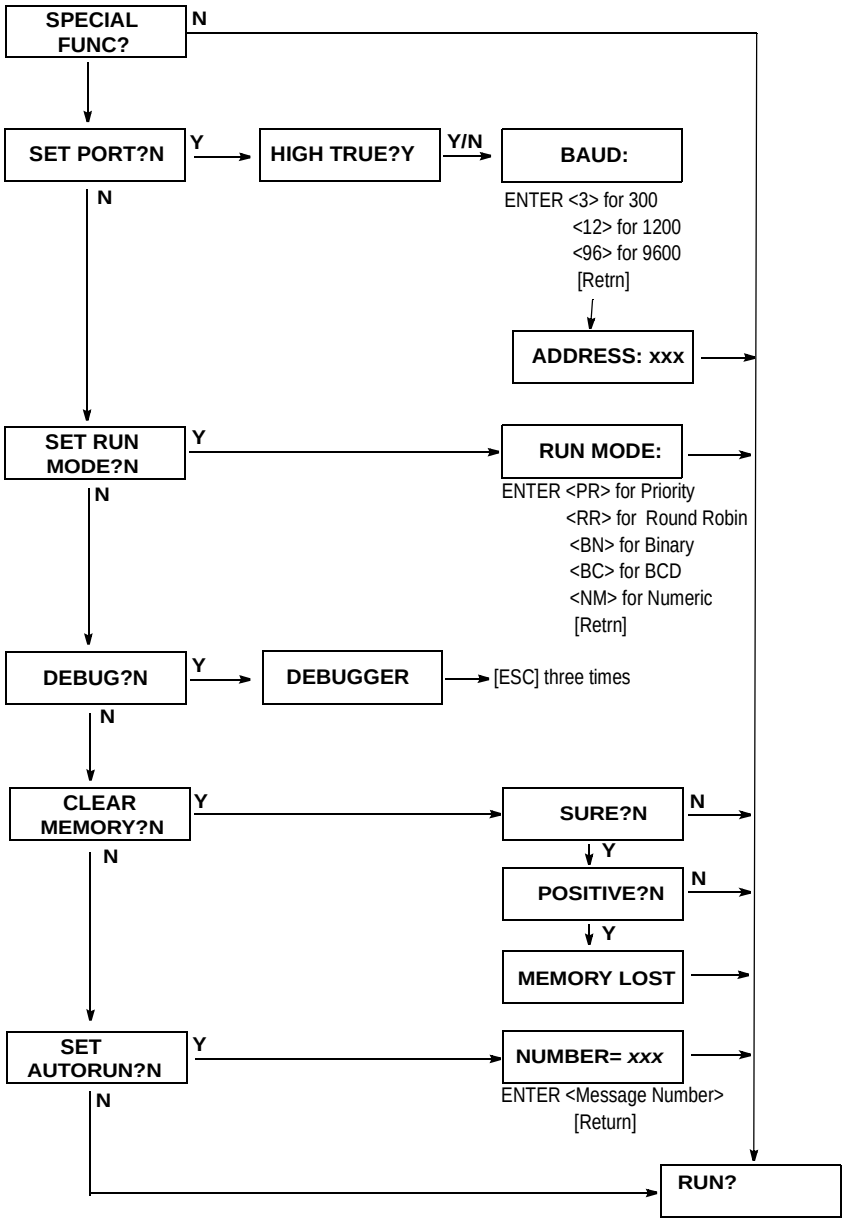
Introducing the Special Functions Menu

The special functions menu is accessed from the main menu. You select the special functions by pressing the [Y] key then the [Retrn] key at the SPECIAL FUNC? prompt. You will then be shown a sequence of prompts for the five special functions. To enter a special function you must press the [Y] key and then the [Retrn] key. If you do not want to enter a particular special function press the [Retrn] key ([N] is the default); the DL5 will then display the next prompt. The five special functions are:

- SET PORT
- SET RUN MODE
- DEBUG
- CLEAR MEMORY
- SET AUTORUN

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The figure below shows a flow chart of the Special Functions menu.



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Entering the Special Functions Menu

To enter the special functions menu, follow the steps below.

1. Make sure the RUN? prompt is displayed:

```
RUN?
```

Note: To get the RUN? prompt from the run mode, press [Esc] three times. From Edit mode it is also necessary to answer [N] to EDIT? and SPECIAL FUNC?.

2. Press the [N] and [Retrn] keys. The DL5 displays:

```
EDIT?
```

3. Press the [N] and [Retrn] keys. The DL5 displays

```
SPECIAL FUNC?
```

4. Press the [Y] and [Retrn] keys to enter the Special Functions menu. The DL5 displays:

```
SET PORT?N
```

The set port prompt is the first special function. To enter the set port function press the [Y] and [Retrn] keys. To enter one of the other four special functions, press the [Retrn] key until the special function that you want is displayed ([N] is the default).

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SET PORT Special Function

The set port function allows you to set the following parallel and serial port parameters.

- positive or negative logic (high true or low true) of the parallel port
- baud rate (300, 1200, or 9600) of the RS-232 serial port
- address of the DL5 (for serial triggering)

You enter the set port function by pressing the [Y] and [Retrn] keys in response to the SET PORT? prompt. After selecting the set port function, the first prompt that the DL5 displays:

```
HIGH TRUE?Y
```

If you answer [Y] (the default) to the high true input option, the DL5 will interpret the voltages on the data lines as positive logic signals. If you answer [N] to the high true option, negative logic is selected.

If positive logic is selected:

- A voltage on a data line is interpreted as an ON (logic 1 / true) condition.
- The absence of voltage on a data line is interpreted as an OFF (logic 0 / false) condition.

If negative logic is selected:

- A voltage on a data line is interpreted as an OFF (logic 0 / false) condition.
- The absence of voltage on a data line is interpreted as an ON (logic 1 / true) condition.

Note: If possible, we recommend that you configure your system so that in a normal operating condition as few as possible input lines have a voltage applied to them. This will keep the DL5 at a lower operating temperature and extend its life.

The next prompt that you must respond to is:

```
Baud (3, 12, 96):96
```

The present baud rate is the default value. Enter the desired baud rate: 3 for 300, 12 for 1200, and 96 for 9600. **The baud rate changes immediately.** The DL5 is shipped with a baud rate of 9600 baud.

Once the baud rate is changed, the baud rate of your programming device must also be changed to match the DL5 before programming/editing of the DL5 can continue. After specifying a baud rate, the current address is displayed:

```
ADDRESS: xxx
```


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After you provide an address, press [Retrn] and the DL5 will display the beginning RUN? prompt.

Run Mode Special Functions

The run mode determines how the DL5 will interpret the data present on the parallel port. The DL5 is shipped in the numeric mode.

```
SET RUN MODE?N
```

To change or view the run mode selection, respond to the SET RUN MODE? prompt by pressing [Y], then [Retrn].The following appears on the display:

```
RUN MODE=xx
```

Where *xx* is the mnemonic for the last entered run mode.

Respond to the RUN MODE = prompt with a two letter mnemonic. The mnemonic that you provide determines which Run Mode is used. The table below lists the run modes of the DL5's parallel port. After you provide a run mode mnemonic the DL5 will return to the RUN? prompt. Once a run mode is selected, the DL5 will enter that run mode on default when power is cycled off, then on. If an invalid mnemonic is entered, the previously selected run mode mnemonic is displayed.

Run Mode	Mnemonic	Description
Priority	PR	Chapter 10
Round Robin	RR	Chapter 10
Binary	BN	Chapter 7
BCD	BC	Chapter 7
Numeric	NM	Chapter 7

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Debug Special Function

The Debug special function is very valuable if you are having difficulty triggering messages properly in the run mode. The debug function allows you to visually determine whether or not a voltage is applied to a DL5 data line. If you respond to the DEBUG? prompt by pressing the [Y] and [Retrn] keys, the DL5 displays the status of the data lines:

```
0000010000010011
```

The debug mode display consists of sixteen characters (ones and zeros). This display represents the condition of the sixteen data lines. The character on the far left represents data line D15 and the character on the right represents data line D0. If you have set the parallel port for negative logic, a voltage on a data line will be represented by a 0. If positive logic is selected, a voltage on a data line will be represented by a 1. For example, assume that a debug mode display appears like this:

```
0000100001100100
```

If positive logic has been selected, the above display would indicate that there is a voltage present on data lines D2, D5, D6, and D11. If negative logic has been selected, the above display would indicate that there is a voltage present on data lines D0, D1, D3, D4, D7, D8, D9,D10, D12, D13, D14, and D15.

To exit the debug mode, press the [Esc] key three times.

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CLEAR MEMORY Special Function

The clear memory special function clears all messages from the DL5 EEPROM memory. To clear the DL5 memory perform the following steps:

1. Press the [Y] and [Retrn] keys in response to the CLEAR MEMORY? prompt. The DL5 displays:

```
SURE?N
```

2. Press the [Y] and [Retrn] keys in response to the SURE? prompt. The DL5 displays:

```
POSITIVE?N
```

3. Press the [Y] and [Retrn] keys in response to the POSITIVE? prompt. The DL5 displays:

```
MEMORY LOST
```

While *Memory Lost* is displayed, the DL5 is actually clearing the EEPROM. Hitting any key, such as [Escape], will not speed up this function. Depending on the amount of the memory used and the size of the EEPROM (2 or 8 Kbytes), it could take up to 30 seconds before *Memory Lost* is cleared and the display shows:

```
RUN?
```

SET AUTORUN Special Function

The set autorun function allows you to set the autorun message number. If the power to the DL5 is interrupted while in the run mode, the DL5 will automatically enter the run mode when the power is reapplied. The autorun message is the first message that the DL5 displays when the DL5 enters the run mode. After the autorun message is displayed the DL5 resumes normal run mode operation. If you press the [Y] and [Retrn] keys in response to the SET AUTORUN? prompt, the DL5 displays:

```
NUMBER:  X
```

Note: X is the value of the last message number edited.

You can now enter the message number of the message that you want displayed when the DL5 is powered up in the autorun mode. Enter the autorun message number (0–999) and then press the [Retrn] key. If no autorun message is desired, enter a 0 (zero). After entering an autorun message number, the DL5 displays the RUN? prompt.

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Using the Variable Data Feature

Chapter Objectives

In this chapter you will learn how to insert up to five digits of variable data in a message. You will learn:

- how to program messages with embedded variables.
- the format of the variable data.
- timing requirements for the transfer of variable data.

Variable Data Limits

The DL5 can accept message triggers and variable data using either the parallel or serial port.

Serial Port - The serial port accepts CTRL-T commands for message triggers and CTRL-V commands for variable data. The range for variable data sent to the serial port is (0-65535). Serial commands always use decimal numeric values (binary and BCD distinctions do not apply).

Parallel Port - The parallel port can be set to accept either binary or BCD formatted data for message triggers and variable data input.

Whichever format (BCD or binary) you select will be used for both the variable data and message triggers. You cannot input message triggers in one format and variable data in another format. The table below shows the largest variable and message number that can be entered for both binary and BCD formats.

Maximum Ranges for Variable Data sent to Parallel Port

Scan Mode	Input Format for Message and Variable Data	Maximum Message Number	Largest Variable Value
BN	Binary	999	16,383
BC	BCD	999	3,999

You cannot enter negative numbers for variable data.

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Creating Messages with Embedded Variable Data

You can program variable data within a message while the message is being created in the edit mode. To embed one digit of a variable, press the [Ctrl] key and [V] keys simultaneously at the location in the message where the variable digit is to appear. The [Ctrl] and [V] command will insert a caret ^ in the message. For example: Assume that the following message is being entered:

```
THE COUNT IS
```

To embed a single digit of a variable, press the [Ctrl] and [V] keys. The DL5 will display the location of the variable in the message:

```
THE COUNT IS^
```

Up to five single digit variables (only four variables allowed with BCD format) can be embedded in a message. The embedded variables do not have to be in consecutive positions in a message. For example: The following message has been entered, the DL5 is set to accept BCD formatted data:

```
^^OF^^BAD
```

If the number 1050 is transferred to the DL5 and the message is triggered, the DL5 will display:

```
10 OF 50 BAD
```


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Embedding a Decimal Point

You can display numbers which have decimal points. The decimal point is inserted just like any other character and it takes up one full character space. Insert a decimal point before or after the [CTRL] [V] by typing [.]. For example, the following steps would be required to create the message "SPEED IS . FPS".

1. Enter the following message:

   SPEED IS

2. Enter the first variable digit by pressing the [Ctrl] and [V] keys:

3. Press the [.] key to enter the decimal point. Notice that the decimal point requires a character position. The decimal point becomes a part of the variable.

4. Then enter the second variable digit by pressing [Ctrl] and [V] keys.

5. Finish entering the message by typing [F] [P] [S].

Note: Use [CTRL][X] to imbed variable digits with leading zeros. [CTRL][V] imbeds variable digits without leading zeros.

Sending Variable Data Through the Serial Port

Use the CTRL-V command to send data for display in Binary, BCD, Numeric, Priority, and Round Robin modes. All values are decimal values. The command has the following format:

CTRL-V	Variable Data	\ Backslash	Variable Position	\ Backslash	DL5 Address	Carriage Return

where:

- Variable Data is 1 to 5 ASCII digits (0-65535)
- Variable Position is single ASCII digit (value is ignored)
- DL5 Address is 1 to 3 ASCII digits (0-127)

For example, to send a value of 500 to a DL5 with an address of 99, the following string would be sent:

ASCII	^V	5	0	0	\	1	\	9	9	^M
HEX	10	35	30	30	5C	31	5C	39	39	0D

Note: In Binary mode, variable data can be in the range 0 to 16,383. In BCD mode, variable data must be in the range 0 to 3999. In Round Robin. Priority and Numeric modes, variable data can be in the range of 0 to 65535.

Note: The CTRL-V command in Priority, Round Robin and Numeric modes triggers messages not variables.

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Parallel Port Strobe and Data Bits

The DL5 uses the sixteen data lines (D0 through D15) to input both variable data and message triggers. Data lines D0 through D13 transfer the fourteen data bits and data lines D14 and D15 are the two strobe lines.

The strobe lines indicate whether the data on the data lines is a message number or variable data. There are four possible combinations of the two strobe lines. The table below lists the four strobe combinations and the DL5's interpretation of the strobe commands.

Strobe Commands

Strobe Command	Strobe Line, Data Line D14	Strobe Line, Data Line D15
Ignore Data Lines	OFF	OFF
Variable Data	ON	OFF
Message Number	OFF	ON
Message Number	ON	ON

Notice that if data line D15 is ON, the DL5 will interpret the data on the data lines as a message number regardless of the condition of data line D14.

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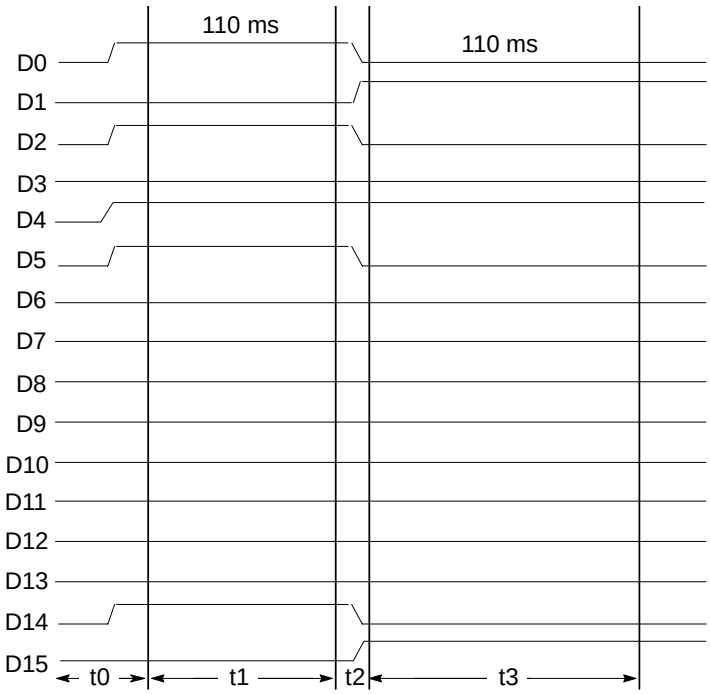
Parallel Port Timing Requirements

The following is an example of how the strobe commands are used. In this example, message #12 , which contains a two digit variable, is triggered. The message that was entered for message #12 appears like this:

```
SPEED IS^.^FPS
```

First the controller sends the variable value (BCD format) for message #12 to the DL5. Then the controller sends the trigger for message #12. The figure below illustrates the timing of the data transfer and message trigger.

BCD Message Number Timing Example



The following describes what occurs during each of the timing intervals.

t0- During t0 the variable data 35 and strobe line D14 to indicate variable data is set on the data lines.

t1- During t1 the value of 35 and strobe line D14 are maintained for 110 milliseconds.

t2- During t2 the message number 12 is placed on the data lines, and D15 is set to indicate a message number. D14 is reset.

t3- During t3 the message number 12 and strobe line D15 are maintained for 110 milliseconds.

The timing example (previous page) shows the minimum hold time (110 milliseconds) that is required for each step of the variable data transfer and message trigger.

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Note: The PLC program scan time must be added to the hold time. If the scan time is 10 milliseconds, then the minimum data hold time in the PLC program should be 120 milliseconds to make sure data is held at the DL5 for the minimum 110 milliseconds.

To summarize the timing requirements:

- Data and strobes are set all at once.
- Once data and strobe lines are set, they must remain unchanged for a minimum of 110 milliseconds.
- The total cycle time for a variable data transfer and message trigger is a minimum of 220 milliseconds. A cycle time of 220 milliseconds allows you to update a variable approximately 4 times per second.

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Suggestions on Using the Variable Data Feature

Message attribute settings are important to the proper functioning of the variable data feature. Refer to Chapter 3 for review of message attributes. The following message attribute settings are recommended.

Line Selection recommendations:

- Do not use the scroll mode when variables are within a message. The message should appear as one or two lines.
- Limit each message to one screen (16 characters if a one line message, 32 characters if a two line message).

Wait Time recommendation:

- Set the wait time of a variable message to zero to allow for the fastest update of the variable.

Auto Clear recommendation:

- Set auto clear to NO.

Auto Repeat recommendation:

- Do not use the auto repeat display option for messages that contain variable data. If the auto repeat display option is selected, the DL5 will resample the data lines for variable data each time the specified message wait time has expired.

Your controller cannot send variable data for a new message trigger until the auto repeat message is halted. You can halt the display of an auto repeat message by triggering a programmed blank message number.

Note: A blank message is one which has been created but has no displayable characters. Its attributes could be Wait Time Zero, Auto Clear No, and Auto Repeat No.

For example, the following describes a triggering sequence that occurs using an auto repeat message with four variable digits. The message being triggered is:

```
^^OF^^BAD
```

This message has a wait time of zero, and no auto clear.

1. First, the controller sends the variable data “1050”.
2. Next, the controller sends the trigger for the message.

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3. The DL5 will then display the message:

```
10 OF 50 BAD
```

4. The controller then transmits a new variable “2040”.

5. The DL5 will then display the message with the new variable data:

```
20 OF 40 BAD
```

6. To enter and display a different message with embedded variable data, the controller must first trigger a programmed blank message to stop display of the variable message.

7. The controller can now send the variable for the new message.

8. The controller can then send the message number for the new message

Updating a Variable Frequently – If your application requires that the variable data within a message be updated frequently, you should program the message with the following attributes:

- A wait time of zero.
- The auto clear function is not selected.

These message attribute settings will make it possible to update variable data at the fastest rate (once every 220 milliseconds). This assumes a normal sequence of events to enter variables and message numbers:

- Send a variable. (110 milliseconds)
- Send a message number. (110 milliseconds)
- Send a variable. (110 milliseconds)
- Send a message number, etc. (110 milliseconds)

Note: PLC program scan time must be added to the 110 millisecond data hold time in the PLC program to assure that data is on the DL5 parallel port for 110 milliseconds.

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Using the DL5 Parallel Port to Replace Pilot Lights

Chapter Objectives

This chapter shows you how to replace up to 16 pilot lights with a single DL5. Descriptions of both the priority and round robin operating modes are provided.

Description of Input Modes

The DL5 has 2 modes of operation which allow you to replace pilot lights:

- **Round Robin input mode** - while in the round robin mode of operation, the DL5 will look at the sixteen data lines as individual inputs. Each of the inputs is like the input wire to an individual pilot light. When a data line to the DL5 is triggered, a message corresponding to that data line is displayed.
- **Priority input mode** - the priority input mode is similar to the round robin input mode except that each of the data lines is assigned a priority in relation to the other data lines.

Note: These pilot light operating modes do not support variable data within a message.

Pilot lights are typically used in one of two ways:

1. Pilot lights can be used as status indicators. For example, a pilot light can inform an operator that a motor is on or off.

2. Pilot lights can also be used as diagnostic indicators. For example, a pilot light can inform an operator that an overload relay is tripped.

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Round Robin Mode

In the Round Robin mode of operation you can specify both an OFF state message and an ON state message for each input. Messages are scanned in sequence beginning with data line D0 and ending with data line D15. If several inputs are ON, the DL5 displays the messages in the sequence that they are scanned. The following table lists the message numbers that are assigned to each of the sixteen inputs.

Data Line No.	ON Message No.	OFF Message No.
D0	1	17
D1	2	18
D2	3	19
D3	4	20
D4	5	21
D5	6	22
D6	7	23
D7	8	24
D8	9	25
D9	10	26
D10	11	27
D11	12	28
D12	13	29
D13	14	30
D14	15	31
D15	16	32

Notice that each of the sixteen data lines listed in the table has both an ON message number and an OFF message number assigned. You do not have to program both an OFF and an ON message for each input. You can program only an ON or only an OFF state message; or no message at all.

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When the DL5 is placed in the round robin mode of operation, the DL5 begins by looking at the first data line D0. One of three events will occur depending upon the condition of the data line and whether or not a message is programmed:

- If data line D0 is in an ON state, the DL5 will display message #1 (if message #1 is programmed). Message #1 is the ON state message for data line D0.
- If data line D0 is in the OFF state, the DL5 will display message #17 (if message #17 is programmed). Message #17 is the OFF state message for data line D0.
- If no message exists, the DL5 will ignore data line D0.

The DL5, will then look at the second data line, D1. One of three events will occur depending upon the condition of the data line and whether or not a message is programmed.

- If data line D1 is in an ON state, the DL5 will display message #2 (if message #2 is programmed). Message #2 is the ON state message for data line D1.
- If data line D1 is in the OFF state, the DL5 will display message #18 (if message #18 is programmed). Message #18 is the OFF state message for data line D1.
- If no message exists, the DL5 ignores data line D1.

The DL5 then looks at the remainder of the data lines, D2 through D15. After data line D15 is scanned, the DL5 will then start the sequence over again beginning with data line D0. If only one data line is on, the display will not clear before retriggering the message associated with that data line. If no data lines are on, the display is cleared after the message wait time has expired.

Note: If a data line is turned ON then OFF before the DL5 scans it, it will not be remembered as being ON by the DL5. The DL5 will not look for additional ON terminals until it is done executing a message it has recognized as ON.

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Priority Mode

In the priority mode of operation you can only specify an ON state message for each input. If several inputs are ON, only the highest priority message will be displayed. The following table lists the message numbers that are assigned to each of the sixteen inputs.

Data Line No.	ON Message No.	OFF Message No.
D0	1	1 (Highest)
D1	2	2
D2	3	3
D3	4	4
D4	5	5
D5	6	6
D6	7	7
D7	8	8
D8	9	9
D9	10	10
D10	11	11
D11	12	12
D12	13	13
D13	14	14
D14	15	15
D15	16	16 (Lowest)

If programmed, message #17 is displayed if no data lines are ON.

Notice that each of the sixteen data lines listed in the table above only has an ON message number assigned. You do not have to program a message for each of the inputs; if an input does not have a message programmed, the DL5 will ignore the input. Each input has an assigned priority level. Data line D0 has priority over data line D1, data line D1 has priority over data line D2, data line D3 has priority over data line D4, etc. The DL5 displays the message number that corresponds to the highest priority data line. For example: If data lines D1, D4, and D7 are in an ON condition, the DL5 will display message #2 (message #2 is the message assigned to data line D1). Message #2 will continue to be repeated for as long as data line D1 remains in an ON state; unless data line D0 changes to an ON state. If data line D0 changes to an ON state, it overrides data line D1 because data line D0 has a higher priority. The DL5 then displays message #1 (message #1 is the message assigned to data line D0). If only one input is ON and that input goes OFF, the display will automatically clear.

In addition to the sixteen messages associated with data lines D0 through D15, there is a message #17. Message #17 is only displayed when none of the data lines is in an ON condition.

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Using the Round Robin Input Mode

If you want to operate the DL5 in the Round Robin mode of operation, perform the following steps:

1. You must decide whether the DL5 will be set for positive or negative logic. If positive logic is selected, voltage on a data line will represent an ON condition. If negative logic is selected, the absence of voltage on a data line represents an ON condition.

2. Select the round robin mode of operation as described in Chapter 8

3. Place the DL5 in the edit mode and program messages for the message numbers that are associated with each input. The following message attribute settings are suggested to provide the clearest round robin functionality.

   – Line 1, line 2, or both lines can be selected as desired.

   – Scroll message can be selected as desired.

   – Wait time can be set as desired and will control how long a message is displayed before the DL5 goes on to the next message.

   – Select Auto Clear, to clear the screen after each message. Otherwise you might have a portion of a two line message remaining on the DL5 when a single line message follows.

   Note: The DL5 will always clear the display when no inputs are on.

   – Auto Repeat has no function in Round Robin mode.

   – Flash Message can be selected as desired.

4. Place the DL5 in run mode.

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Using Priority Input Mode

In Priority Input mode, only one message (the highest priority) can be on the screen at a time.

If you want to operate the DL5 in priority mode, follow these steps:

1. You must decide whether the DL5 will be set for positive or negative logic. If positive logic is selected, voltage on a data line will represent an ON condition. If negative logic is selected, the absence of voltage on a data line represents an ON condition. Chapter 8 describes how you can set the DL5 for either positive or negative logic.

2. Select the round robin mode of operation as described in Chapter 8.

3. Place the DL5 in the edit mode and program messages for the message numbers that are associated with each input. Chapter 3 describes how to enter messages.

   The following message attribute settings are suggested to provide the clearest round robin functionality.

   – Line 1, line 2, or both lines can be selected as desired.

   – Scroll message can be selected as desired.

   – Wait time can be set as desired and will control how long a message is displayed before the DL5 goes on to the next message.

   – Select Auto Clear, to clear the screen after each message. Otherwise you might have a portion of a two line message remaining on the DL5 when a single line message follows.

Note: The DL5 always clears the display when no inputs are on.

   – Auto Repeat has no function in Round Robin mode.

   – Flash Message can be selected as desired.

4. Place the DL5 in run mode.

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Using the DL5 to Replace BCD Displays and Lookup Tables

Chapter Objectives

This chapter provides instructions on how to replace a 2 or 3-digit BCD numeric display and any associated lookup tables with a single DL5.

Replacing a BCD Fault Code Display

The first step in replacing a BCD display is to determine if your DL5 has enough memory to store all of the BCD codes. Typically a BCD display is used in conjunction with a lookup table. If a code is displayed on the BCD display, an operator will refer to a lookup table to determine the meaning of the code. If you are going to replace a BCD display and lookup table with a DL5 you must make sure that the DL5 can store the meanings of all the codes listed in the BCD lookup table. The DL5 can store 94 or 387 message blocks depending on memory size (2K or 8K).

Note: Memory capacity is given in the number of message blocks that are available. Some of the messages that you enter may require more than one message block. A message block is one line of 16 characters.

After you have determined that the DL5 has sufficient capacity to store the messages, perform the following steps:

1. You must set the DL5 to accept positive logic. If positive logic is selected, voltage on a data line will represent an ON condition.

2. Set the DL5 to accept BCD input as described in Chapter 8.

3. Place the DL5 in the edit mode and program messages for the message numbers that were previously displayed on the BCD display.

4. Tie strobe line D15 high to indicate message numbers by wiring it to a 5-24 VDC source.

5. Place the DL5 in the run mode.

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Installation Instructions

Chapter Objectives

In this chapter you will learn how to:

- Mount the DL5 in a panel or an enclosure.
- How to wire the DL5 to your control system.

Grounding

Grounding is an important safety measure in installing the DL5. As with all solid-state systems, grounding also helps limit the effect of noise due to electromagnetic interference (EMI). The DL5 mounting studs and nuts (once tightened) connect the DL5 chassis to your equipment ground.

Note: The common terminal on the back of the DL5 is not equipment ground. The common terminal must be connected separately to your power supply common.

Wire Routing

Careful wire routing helps reduce electrical noise. Route all DL5 wiring separately and away from all high voltage wiring (115VAC or above). Do not run the DL5 wiring in the same conduit as any AC power wiring (115 VAC and above). When high voltage wiring and the DL5 wiring must cross, their intersection should be perpendicular. In addition, the data line wiring (D0-D15) should be routed away from transformers, solenoids, or other devices that are known to generate electrical noise (EMI).



ATTENTION: Fusing the DL5 power wiring is important to protect both the power supply and the DL5 from damage should a short circuit occur. Since the DL5 has no fuses, we recommend you use external fusing.



ATTENTION: You must connect the common lead of the power source to the DL5. Failure to connect the common lead may result in electrical shock. In addition, the common lead protects the DL5 from electrical noise. Do not apply power to the display until all wiring to the DL5 is completed.

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ATTENTION: To avoid ground loops and damage to the equipment, the same power supply must be used for the parallel port and the power input to the DL5.

Mounting the DL5

You can mount the DL5 in a custom panel or enclosure.

When the DL5 is properly installed, the faceplate of the DL5 provides a NEMA Type 12/13 and 4 enclosure integrity rating. To mount the DL5:

1. Punch and drill the appropriate mounting holes in the enclosure or panel. The following page shows the mounting dimensions of the DL5.

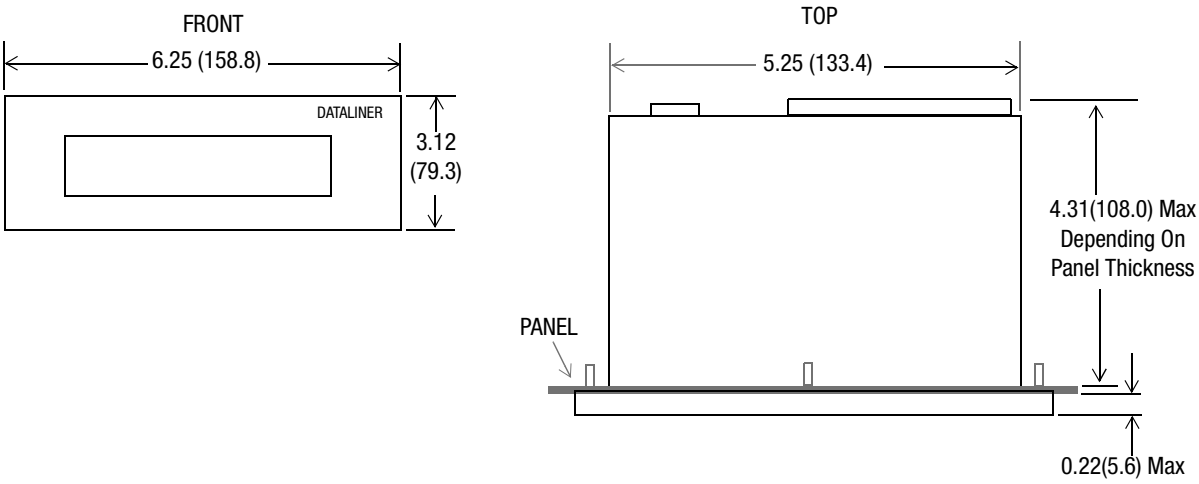
ATTENTION: DO NOT install the DL5 until all cutouts and holes are completed. Metal filings may fall into and damage the DL5.

2. Remove the four nuts from the mounting studs on the DL5's face plate.

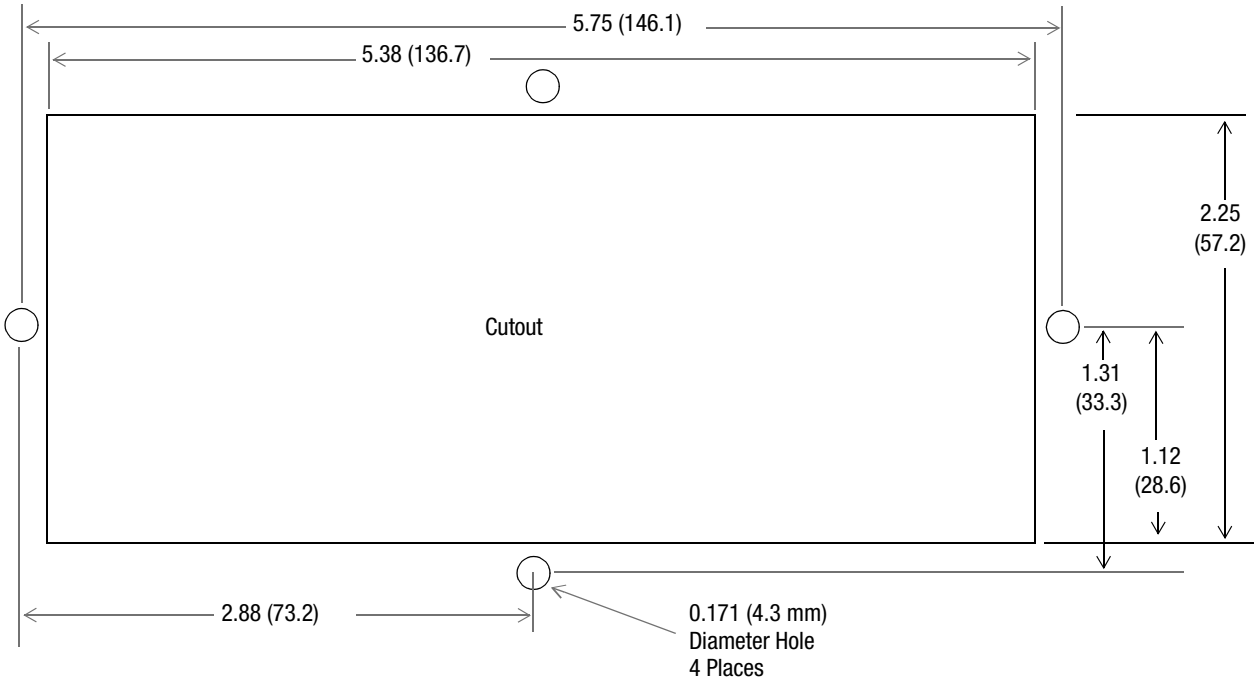
3. Install the display in the panel cutout and tighten the four nuts on the mounting studs to a torque of 9 lb-in (1.02Nm).

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DL5 Mounting Dimensions in Inches (Millimeters)



PANEL CUTOUT DIMENSIONS



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Power Supply Requirement

ATTENTION: To avoid system ground loops and damage to equipment, the same power supply must be used for the parallel port and the power input to the DL5.

The power supply used to power the DL5 and to supply the parallel port data lines must meet the following specifications:

Supply Voltage:	12-24 VDC
Ripple:	5% of input voltage p-p (max.)
Noise:	5% of input voltage p-p (max.)

Supply Current

12 VDC	250 mA operating (300 mA inrush)
24 VDC	125 mA operating (300 mA inrush)

Parallel Port: (17 inputs maximum)

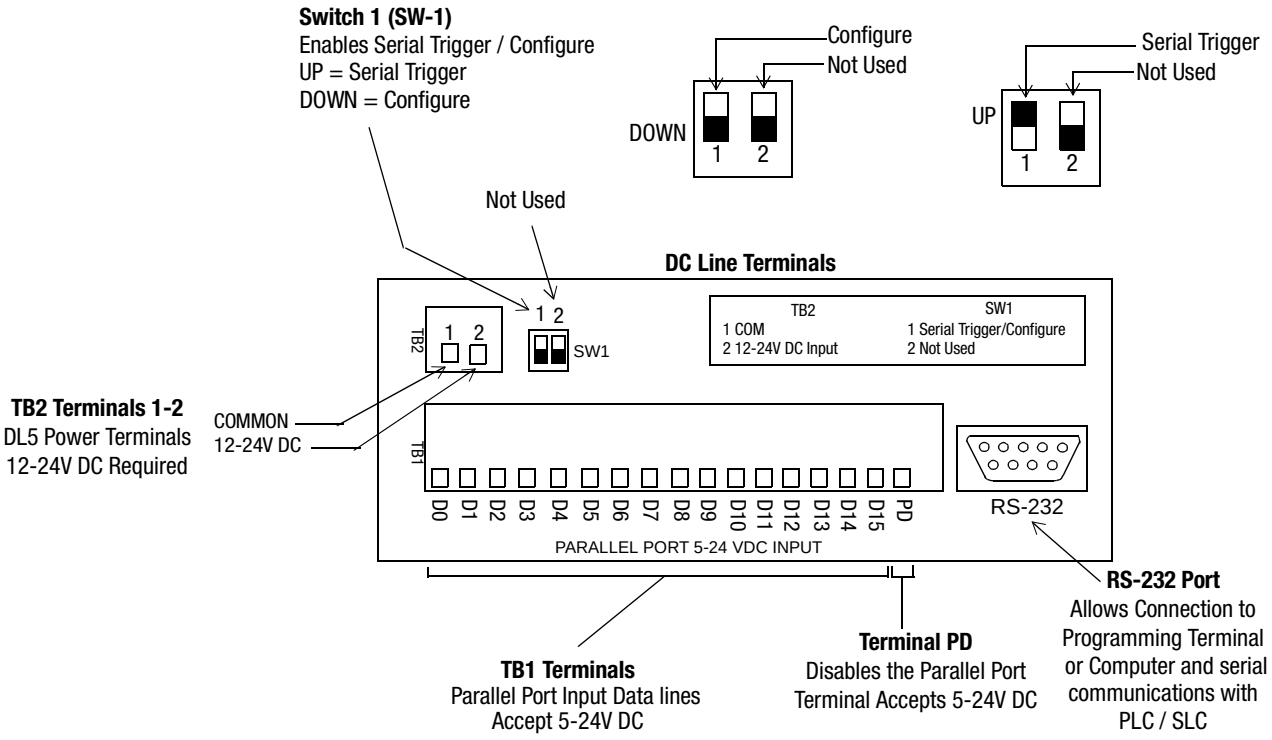
5 VDC	3.0 mA per input (typical)
12 VDC	7.3 mA per input (typical)
24 VDC	14.6 mA per input (typical)

Fusing: External fusing should be provided.

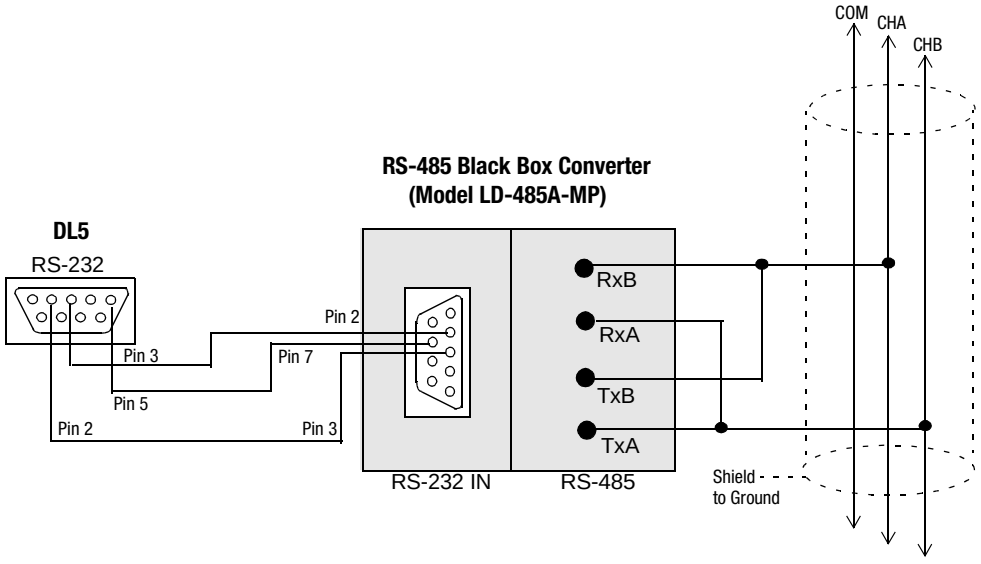
After the DL5 has been mounted, the necessary wiring can be connected to the DL5. The following figure illustrates the terminal connections located on the back of the DL5. Perform the following steps to connect wiring to the DL5.

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Wiring the DL5 (Rear View)



RS-485 Multidrop Connections



RS-485 Black Box Converter Notes:

1. Set RTS/CTS delay time to 5 milliseconds.
2. Set switch S2 to the unterminated position.
3. If the RS-485 Driver Enable is set to *Enable When Data is Received* on the RS-232 port (Jumper W15 is in the B-C position), set the Disable Timeout Delay (Jumper W17) to 100 msec or greater when communicating at lower Baud rates (300 or 1200 Baud).

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Power / Parallel Port Wiring

The parallel port data inputs and power inputs are wired by means of pull-off terminal strips. These strips may be removed and wired separately, and then inserted onto the unit after the unit is mounted in the enclosure.

1. Connect a 12-24 VDC input voltage source to the DL5 power terminals (TB2).

- The hot lead of the power source is connected to terminal #2 (12-24 VDC).
- The common lead of the power source is connected to terminal #1.



ATTENTION: There are no fuses contained in the DL5. Therefore, we recommend that external fusing be used to avoid any possible damage to the DL5 or power supply.



ATTENTION: You must connect the common lead of the power source to the DL5. Failure to connect the common lead may result in electrical shock. In addition, the common lead protects the DL5 from electrical noise. Do not apply power to the display until all wiring to the DL5 is completed.

2. Connect the communication lines from the host programmable controller, computer, or other controlling devices to the DL5 parallel or serial ports.



ATTENTION: The common for the parallel port should be the same common as the power source.

Note: To ensure proper connection through the pull-off terminals, strain relief must be provided for all DL5 wiring.

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Maintenance and Troubleshooting

Troubleshooting Chart

This chapter provides general maintenance and troubleshooting instructions. A troubleshooting chart is provided to aid you in determining the cause of a malfunction.

The table below lists the most common operating problems and possible solutions. The DL5 does not contain user serviceable components.

Troubleshooting Chart

Problem	Probable Causes	Corrective Action(s)	Reference
DL5 does not power up.	1. Loose or incorrect wiring to DL5 (TB2) 2. Blown power supply fuse. 3. Bad power supply	1. Check for proper wiring and that connector TB2 is properly inserted. 2. Check external power supply fuse. 3. Check power supply output.	Chapter 12 N/A 12
Programming terminal or computer does not communicate with the DL5.	1. Baud rate of terminal or computer does not match the DL5. 2. Incorrect connection cable.	1. Set Baud rate of terminal to match the DL5. 2. Check that the proper cable is being used.	2, 8 6, Appendix B

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Problem	Probable Causes	Corrective Action(s)	Reference
Messages do not trigger properly. Messages are not displayed when triggered. "INVALID MSG#" is displayed on DL5	1. Parallel port voltages are not per DL5 requirements. 2. Serial Trigger / Configure DIP switch SW1-1 is not in correct position. 3. Message number is not present on the DL5 data lines for the required hold time. 4. Strobe lines are not being set to indicate message numbers. 5. Incorrect Run mode is selected. 6. Messages being triggered do not exist (INVALID MSG#)	1. Check the voltage range of your controller outputs. 2. Check the setting of DIP switch SW1-1 3. Configure your control systems so message numbers are held on the data lines for a minimum of 110 milliseconds. 4. Configure your control system to set the data lines to indicate message number. 5. Set Run mode to match the type of output used by the control system (Binary, BCD, etc.). 6. Program the messages into the DL5. **Note:** In all cases use the debug mode (Chapter 8) to verify that the inputs to the DL5 parallel port are correct.	7, 12 2 7 7, 8 8 3
Messages with embedded variables are not displayed properly.	1. Strobe lines are incorrectly set. 2. Data and strobe line timing requirements are not met. 3. Incorrect Run mode is selected 4. Ctrl-V characters incorrectly embedded in message.	1. Configure the control system to set the strobe lines for the type of data (message number or variable data) being sent. 2. Configure the control system to meet timing requirements. 3. Set the Run Mode to match the type of outputs used by the control system. 4. Check for proper insertion of Ctrl-V characters.	9 9 8 9
Delays exist between messages (the screen is blank).	1. Blank message block created at the end of a message due to typing Control J at end of edit.	Edit the message and remove any blank message blocks.	3

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Specifications

Electrical

Input Power Requirements

Current:	250 mA maximum steady-state @ 12 VDC input.
Power:	3 Watts maximum
Ripple:	5% of input voltage p-p maximum
Noise:	5% of input voltage p-p maximum

Voltage

12-24 VDC

Operating and Inrush Currents

12 VDC	250 mA oper. (300 mA inrush)
24 VDC	125 mA oper. (300 mA inrush)

Parallel Port

16 data input lines (14 data lines and 2 strobe lines for BCD and Binary modes) and 1 parallel port select input.

Parallel Port Data Input Voltage

5 to 24 volts DC

Voltage Levels for Positive Logic

High:	
Recognized	3.5 to 24.0 VDC
Indeterminate	0.9 to 3.5 VDC
Low:	
Recognized	0.0 to 0.9 VDC
Indeterminate	0.9 to 3.5 VDC

Voltage Levels For Negative Logic

Low:	
Recognized	3.5 to 24.0 VDC
Indeterminate	0.9 to 3.5 VDC
High:	
Recognized	0.0 to 0.9 VDC
Indeterminate	0.9 to 3.5 VDC

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Data Input Current (typical per input)

5 VDC	3.0 mA
12 VDC	7.3 mA
24 VDC	14.6 mA

Serial Programming Port

RS-232

Memory

- 2K EEPROM - 94 message blocks
- 8K EEPROM - 387 message blocks

Environmental

Operating Temperature

32°F to 122°F (0° to 50°C)

Storing Temperature

-40° to 185°F (-40° to 85°C)

Humidity

5% to 95% - No condensation

NEMA

NEMA Type 12, 13 and 4 (indoor use only) panel mount.

Noise Susceptibility

Passes ICS 2–230 showering arc noise immunity test.

Approximate Weight

1.5 lbs. (0.68 kg.)

Approximate Shipping Weight

3.0 lbs. (1.35 kg.)

U.L. Listing

Class 1, Division 2, Groups A, B, C, D Hazardous Location

CSA Certification

Class 1, Division 2, Groups A, B, C, D Hazardous Location

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Display Characteristics

Character Height

One line display - .262 in. (6.65 mm.)
Two line display - .216 in. (5.5 mm.)

Character Set

Alphanumeric - upper case only

Characters Per Line

16

Character Type

Vacuum fluorescent, 14 segment (plus “,” and “.”) characters

Approximate Viewing Distance

10 feet (3 meters)

Programming

Using RS-232 port and an ASCII ”dumb terminal” or IBM compatible computer with off-line program.

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ASCII Character Set

DL5 Character Set

Dec	Oct	Hex	Char	Control Code	Dec	Oct	Hex	Char	Dec	Oct	Hex	Char	Dec	Oct	Hex	Char
0	000	00	NUL	CTRL @	32	040	20	SP	64	100	40	@	96	140	60	`
1	001	01	SOH	CTRL A	33	041	21	!	65	101	41	A	97	141	61	a
2	002	02	STX	CTRL B	34	042	22	"	66	102	42	B	98	142	62	b
3	003	03	ETX	CTRL C	35	043	23	#	67	103	43	C	99	143	63	c
4	004	04	EOT	CTRL D	36	044	24	$	68	104	44	D	100	144	64	d
5	005	05	ENQ	CTRL E	37	045	25	%	69	105	45	E	101	145	65	e
6	006	06	ACK	CTRL F	38	046	26	&	70	106	46	F	102	146	66	f
7	007	07	BEL	CTRL G	39	047	27	'	71	107	47	G	103	147	67	g
8	010	08	BS	CTRL H	40	050	28	(	72	110	48	H	104	150	68	h
9	011	09	HT	CTRL I	41	051	29	)	73	111	49	I	105	151	69	i
10	012	0A	LF	CTRL J	42	052	2A	*	74	112	4A	J	106	152	6A	j
11	013	0B	VT	CTRL K	43	053	2B	+	75	113	4B	K	107	153	6B	k
12	014	0C	FF	CTRL L	44	054	2C	,	76	114	4C	L	108	154	6C	l
13	015	0D	CR	CTRL M	45	055	2D	-	77	115	4D	M	109	155	6D	m
14	016	0E	SO	CTRL N	46	056	2E	.	78	116	4E	N	110	156	6E	n
15	017	0F	SI	CTRL O	47	057	2F	/	79	117	4F	O	111	157	6F	o
16	020	10	DLE	CTRL P	48	060	30	0	80	120	50	P	112	160	70	p
17	021	11	DC1	CTRL Q	49	061	31	1	81	121	51	Q	113	161	71	q
18	022	12	DC2	CTRL R	50	062	32	2	82	122	52	R	114	162	72	r
19	023	13	DC3	CTRL S	51	063	33	3	83	123	53	S	115	163	73	s
20	024	14	DC4	CTRL T	52	064	34	4	84	124	54	T	116	164	74	t
21	025	15	NAK	CTRL U	53	065	35	5	85	125	55	U	117	165	75	u
22	026	16	SYN	CTRL V	54	066	36	6	86	126	56	V	118	166	76	v
23	027	17	ETB	CTRL W	55	067	37	7	87	127	57	W	119	167	77	w
24	030	18	CAN	CTRL X	56	070	38	8	88	130	58	X	120	170	78	x
25	031	19	EM	CTRL Y	57	071	39	9	89	131	59	Y	121	171	79	y
26	032	1A	SUB	CTRL Z	58	072	3A	:	90	132	5A	Z	122	172	7A	z
27	033	1B	ESC	CTRL [	59	073	3B	;	91	133	5B	[	123	173	7B	{
28	034	1C	FS	CTRL \	60	074	3C	<	92	134	5C	\	124	174	7C	|
29	035	1D	GS	CTRL]	61	075	3D	=	93	135	5D	]	125	175	7D	}
30	036	1E	RS	CTRL ^	62	076	3E	>	94	136	5E	^	126	176	7E	~
31	037	1F	US	CTRL _	63	077	3F	?	95	137	5F	_	127	177	7F	

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Cabling Diagrams

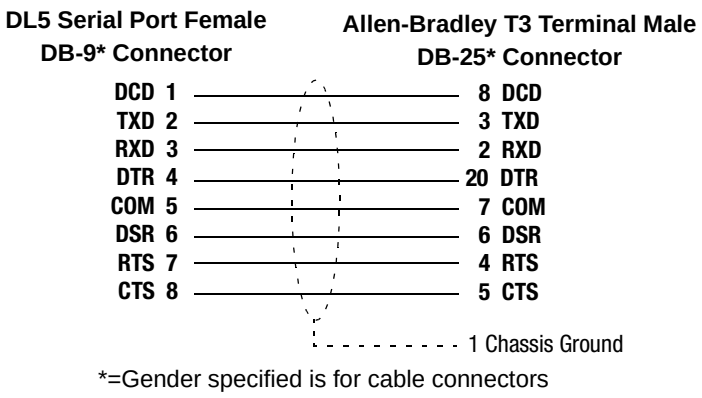
Abbreviations

The following table describes the abbreviations used in this appendix.

Abbreviation	Signal
CTS	Clear to Send
DCD	Data Carrier Detect
DSR	Data Set Ready
DTR	Data Terminal Ready
COM	Signal Common
RI	Ring Indicator
RTS	Request to Send
RXD	Received Data
TXD	Transmitted Data

Allen-Bradley T3 Terminal Serial Communications Cable (Catalog No. 2706-NC15)

Allen-Bradley T3 Cable

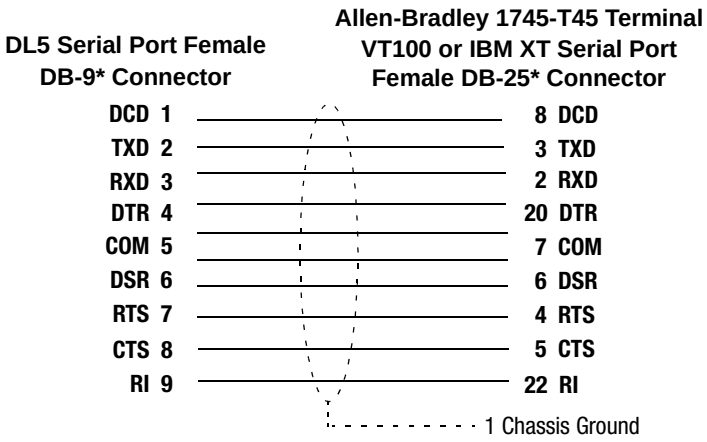


*=Gender specified is for cable connectors

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Allen-Bradley 1745-T45 Terminal, VT100 or IBM XT & Compatibles - Serial Communications Cable (Cat. No. 2706-NC12)

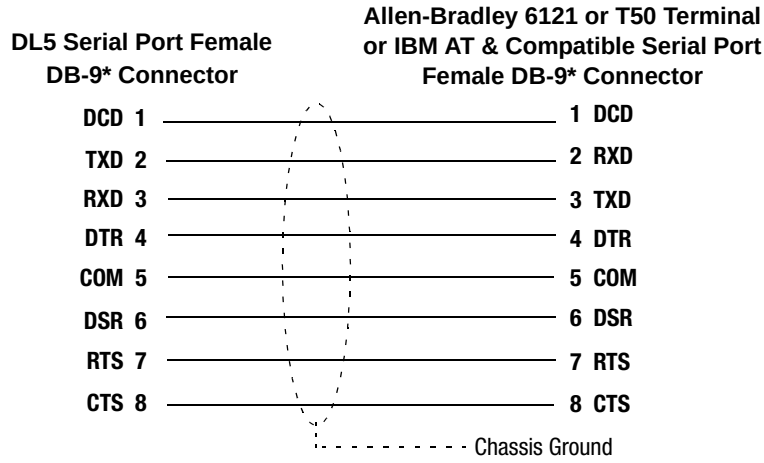
Allen-Bradley 1745-T45, VT100, IBM XT Cable



*=Gender specified is for cable connectors

Allen-Bradley 6121 or T50 Terminal, IBM AT & Compatibles Serial Communications Cable (Cat.No. 2706-NC13)

Allen-Bradley 6121 or T50, IBM AT Cable

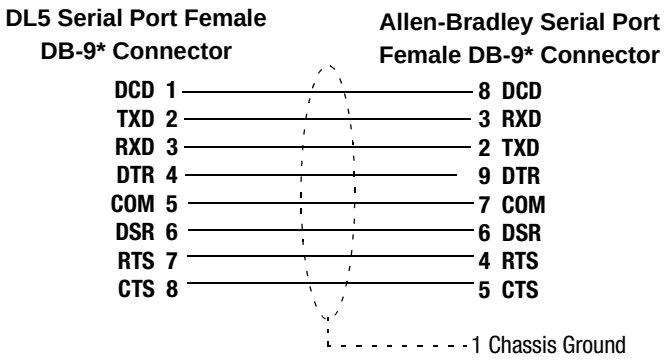


*=Gender specified is for cable connectors

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Allen-Bradley 6120 or Industrial PC / XT Serial Communications Cable (Cat. No. 2706-NC14)

Allen-Bradley 6120 or Industrial PC/XT Cable



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Message Display Worksheets

DL5 One Line Worksheet

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

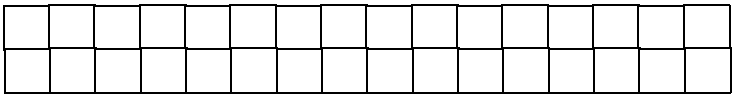
MESSAGE NUMBER _____

Scroll Mode = Y or N
Wait Time = _____
Auto Clear = Y or N
Auto Repeat = Y or N
Flash Message = Y or N

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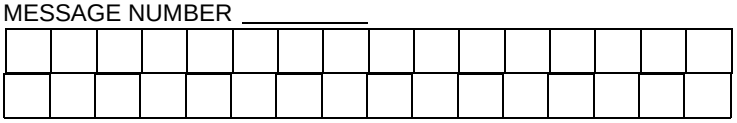
DL5 Two Line Worksheet

MESSAGE NUMBER _____



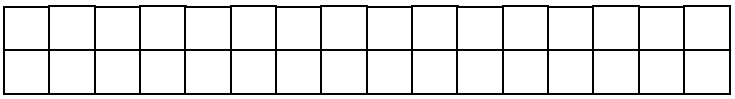
Use Both =	Y or N
Use Line 1 =	Y or N
Use Line 2 =	Y or N
Use Least =	Y or N
Scroll Mode =	Y or N
Wait Time =	Y or N
Auto Clear =	Y or N
Auto Repeat =	Y or N
Flash Message =	Y or N

MESSAGE NUMBER _____



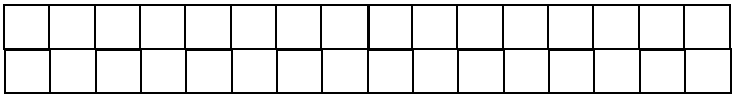
Use Both =	Y or N
Use Line 1 =	Y or N
Use Line 2 =	Y or N
Use Least =	Y or N
Scroll Mode =	Y or N
Wait Time =	Y or N
Auto Clear =	Y or N
Auto Repeat =	Y or N
Flash Message =	Y or N

MESSAGE NUMBER _____



Use Both =	Y or N
Use Line 1 =	Y or N
Use Line 2 =	Y or N
Use Least =	Y or N
Scroll Mode =	Y or N
Wait Time =	Y or N
Auto Clear =	Y or N
Auto Repeat =	Y or N
Flash Message =	Y or N

MESSAGE NUMBER _____



Use Both =	Y or N
Use Line 1 =	Y or N
Use Line 2 =	Y or N
Use Least =	Y or N
Scroll Mode =	Y or N
Wait Time =	Y or N
Auto Clear =	Y or N
Auto Repeat =	Y or N
Flash Message =	Y or N

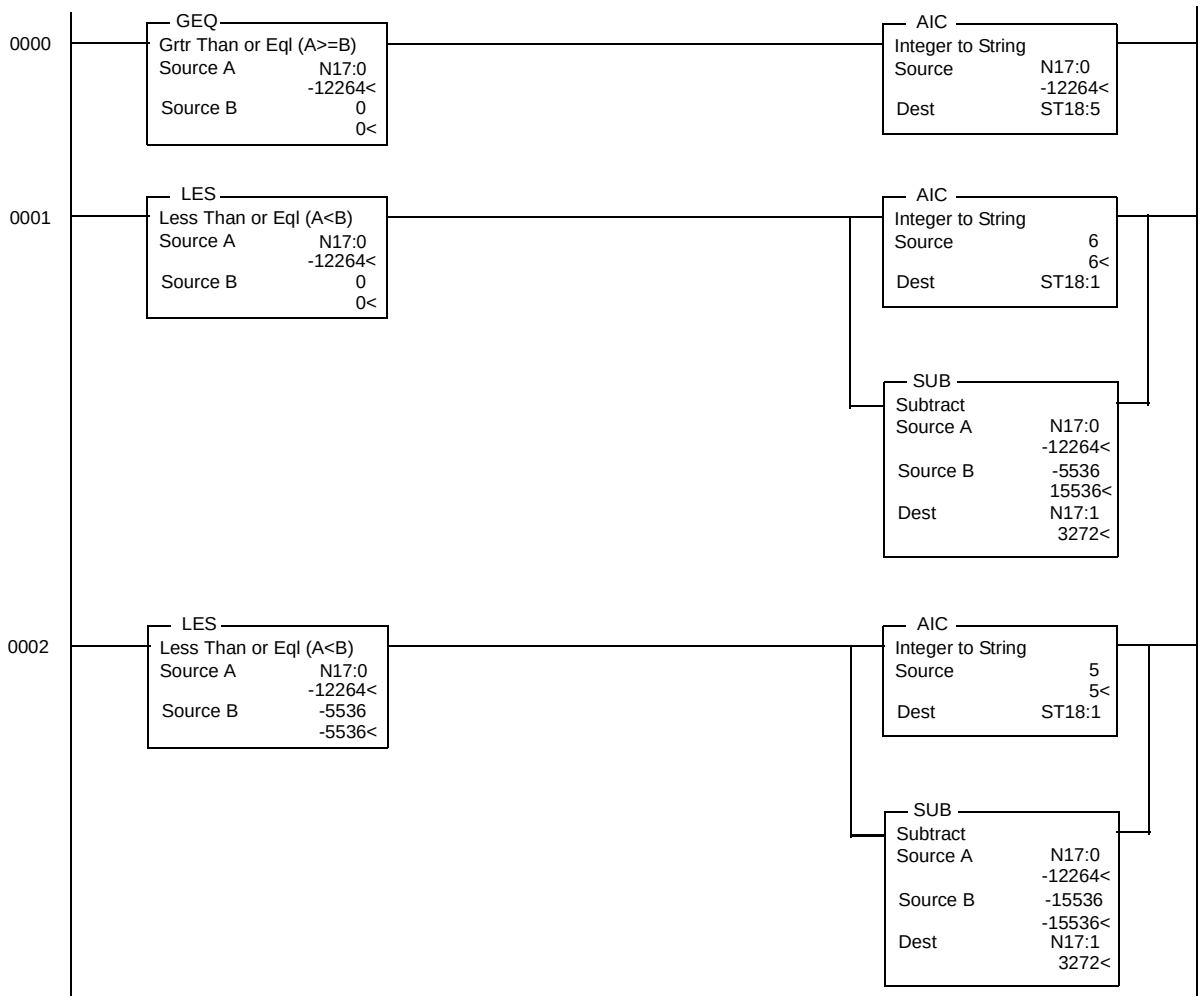
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Application Notes

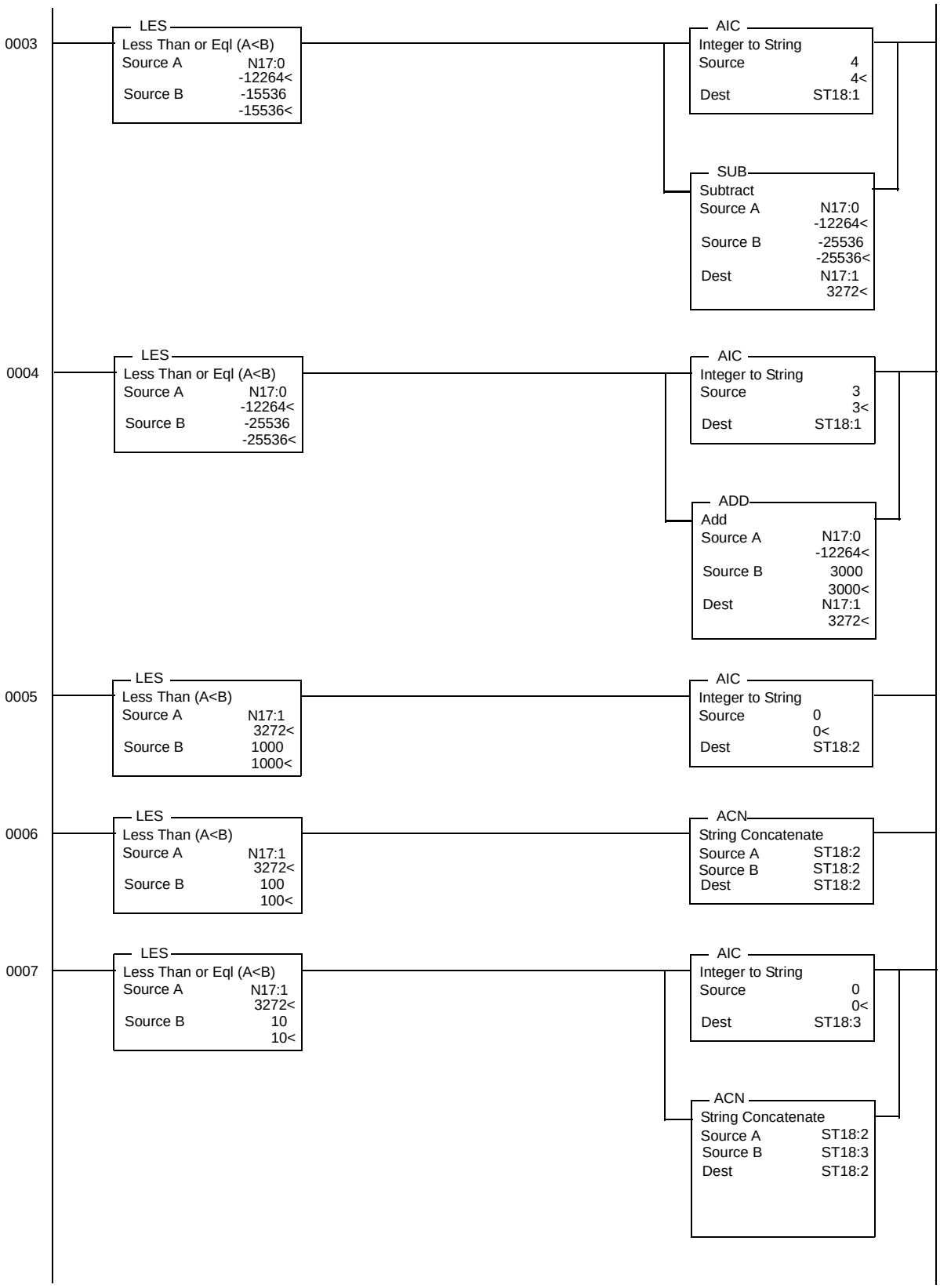
Unsigned Integer to String Conversion

Serial protocol uses decimal values in the range of 0 to 65535 to send variable data (Ctrl-V command). PLCs that do not support unsigned integers can only generate values in the range of -32768 to 32767. To send decimal values in the range used by the serial protocol, use the following ladder logic. This program converts a 16-bit signed integer to an unsigned ASCII decimal string. The ASCII decimal string can then be used to generate serial commands for the DL5.

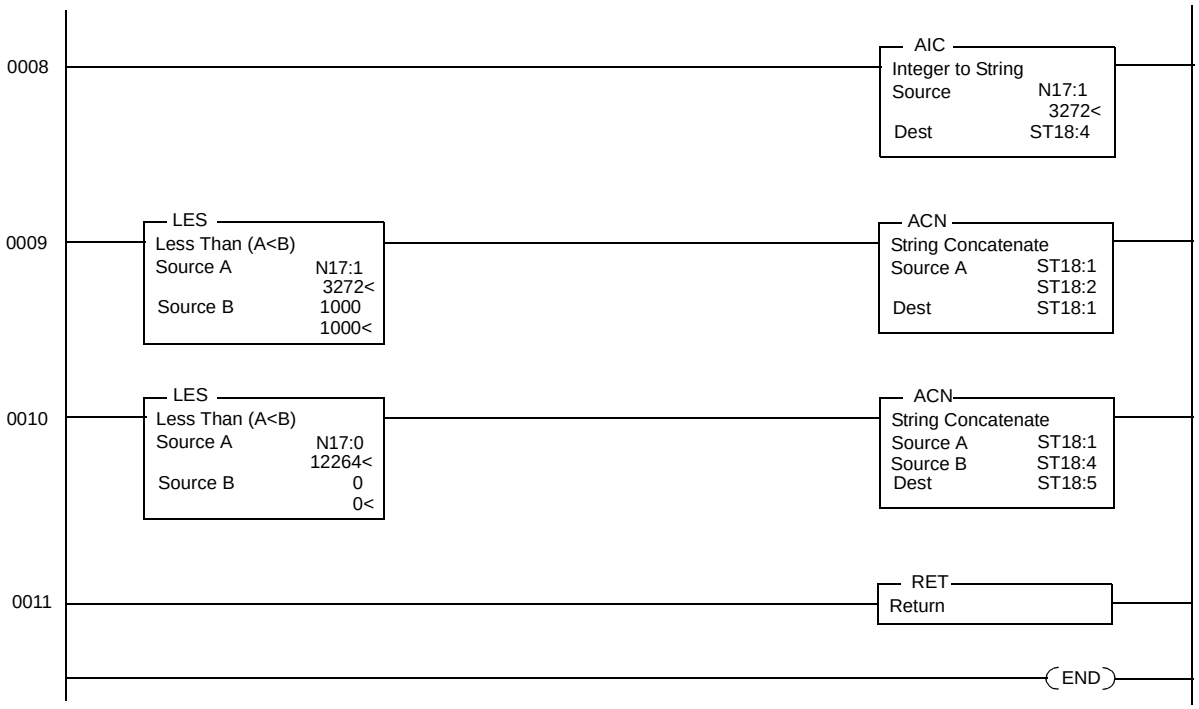
In this example, the 16-bit integer is in N17:0 (signed value = -12264, unsigned value = 53272). The conversion uses N17:1 and ST18:1-4 as temporary buffers. The ASCII decimal string is returned in ST18:5. The conversion routine ladder logic is as follows:



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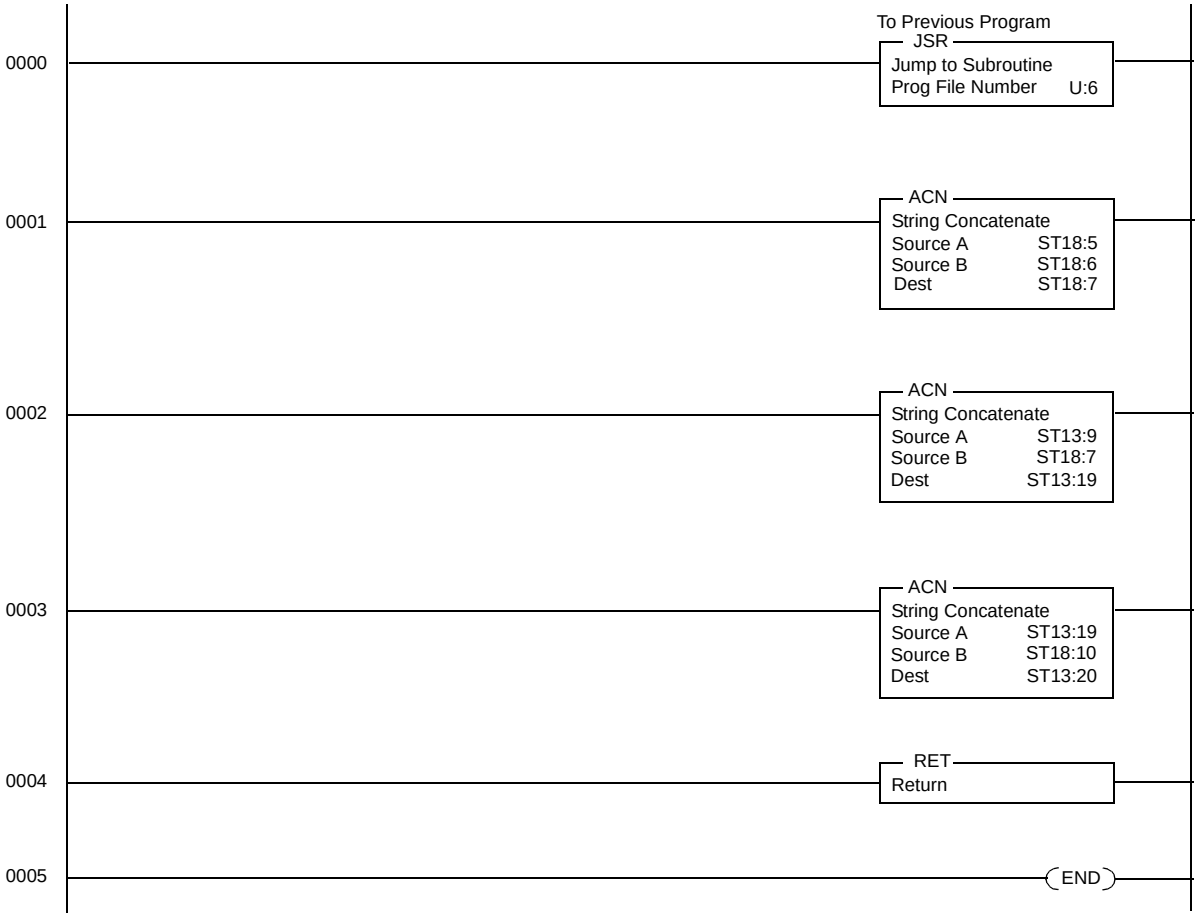
Generate DL5 Variable Data (Ctrl-V) Command

The conversion routine generates a DL5 Ctrl-V command. In this example, the 16-bit signed integer is in N17:0. the ^V is in ST13:9 and \\1\\127^M^M is in ST13:10 The ladder program below converts the integer to an unsigned ASCII string (using the previous conversion program) U:6 and then creates the Ctrl-V serial command string in ST13:20 This command can then be sent out to the DL5.

CTRL-V	Variable Data	\ Backslash	Variable Position	\ Backslash	DL5 Address	Carriage Return

For example: Send 53272 to DL5 with address of 127

ASCII	^V	5	3	2	7	2	\	1	\	1	2	7	^M
HEX	16h	35h	33h	32h	37h	32h	5Ch	35h	5Ch	31h	32h	37h	0Dh



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DL5 Edit Commands

Keys Pressed	Command Function
[CTRL] [A]	Allows access to previously entered message attributes so they can be reviewed or changed.
[CTRL] [C]	Centers a message on the display.
[CTRL] [D]	Deletes a single message block.
[CTRL] [E]	Erases an entire message.
[CTRL] [F]	Shows the number of message blocks that are not programmed (free).
[CTRL] [H]	Moves the cursor one character position to the left.
[CTRL] [I]	Inserts a message block between two previously entered message blocks.
[CTRL] [J]	Creates a new message block after previously entered message blocks or moves the cursor one message block towards the end of a message.
[CTRL] [K]	Moves the cursor one message block towards the beginning of a message.
[CTRL] [L]	Moves the cursor one position to the right.
[CTRL] [Q]	Exits the edit mode with save.
[CTRL] [R]	Runs a message in the edit mode.
[CTRL] [V]	Imbeds a single digit variable in a message. Displays the data without leading zeros.
[CTRL] [X]	Imbeds a single digit variable in a message with leading zeros.

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